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¹ Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

VOL. 37.

ABSTRACT NUMBER.

No. 3.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The preparation of pure crystalline mannose and a study of its mutarotation, C. S. HUDSON and H. L. SAWYER (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 3, pp. 470-478).—A method of crystallizing mannose directly and in large yield from the products of acid hydrolysis of vegetable ivory (the endosperm of the seed of the tagua palm, *Phytelphas macrocarpa*) has been devised and is described in detail. The rate of mutarotation of an aqueous solution was carefully studied, the results indicating that it is similar to that of other aldose and ketose sugars and is caused by a balanced reaction between α -mannose and β -mannose.

The acetyl derivatives of the sugars, C. S. HUDSON (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 4, pp. 380-382).—An address delivered at the presentation of the Nichols medal to the author, March 10, 1916.

A relation between the chemical constitution and the optical rotatory power of the phenylhydrazids of certain acids of the sugar group, C. S. HUDSON (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 3, pp. 462-470).

The reactions of both the ions and the molecules of acids, bases, and salts; the inversion of menthone by sodium, potassium, and lithium ethylates, V. A. GRUEN and S. F. ACREE (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 3, pp. 76-88, *figs. 3*).

Concerning the failure to detect ornithin in plants, A. KIZEL (KISEL) (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1915, No. 15, pp. 661-665).—The author considers previous failures to detect ornithin in plants to be due to the lack of proper conditions for successful analyses. Experiments were conducted with ornithin obtained from arginin from edestin of hempseed by the action of arginase from liver and from wheat sprouts. From the results of the experiments it is concluded that the following conditions are necessary for the best precipitation of ornithin by phosphotungstic acid: More concentrated solutions of ornithin; a large excess of phosphotungstic acid to reduce the solubility of the precipitated ornithin; increased acidity of the solution during precipitation; washing of the precipitate with phosphotungstic acid or a mixture of phosphotungstic and sulphuric acids, rather than with 5 per cent sulphuric acid alone; and allowing the precipitate to stand for some time before filtration, as the precipitate forms very slowly.

Decomposition of pyrrolic acid by dead plants in the presence of a hydrogen acceptor, V. I. PALLADIN, E. I. LOVCHINOVSKAYA, and A. I. ALEKSEYEV (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1915, No. 7, p. 539-590).—In earlier work the authors have studied the influence exerted by hydrogen acceptors on alcoholic fermentation and respiration of plants, as

well as on the decomposition of individual organic compounds in the course of these processes. Pyroracemic acid appeared among the decomposition products in both cases. In the work submitted the effect of the addition of methylene blue on the process of decomposition of pyroracemic acid resulting in the formation of acetaldehyde and carbon dioxide was determined.

In general, it is concluded that methylene blue retards the decomposition of potassium pyroracemate by old yeast and the sprouts of wheat, especially during the first hours of the reaction. A slight stimulation, however, was observed with pea seeds. The formation of acids takes place along with the activity of carboxylase. Methylene blue is considered to take up the hydrogen of water and thus favor the accumulation of acids through the remaining oxygen.

Activity of reductase and carboxylase in decomposition of lactic acid by yeasts. V. I. PALLADIN, D. A. SABININ, and E. I. LOVCHINSKAYA (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1915, No. 8, pp. 701-718).—The results of the investigation reported are summarized as follows:

The decomposition of potassium lactate by dead yeast in the presence of methylene blue leads to a splitting off of carbon dioxide with the production of acetaldehyde. Theoretically, one-half of the carbon dioxide should be in the free state and the other combined as potassium carbonate, but in reality a much larger quantity of carbon dioxide is given off. If the decomposition of potassium lactate by dead yeast takes place in a current of air oxygen is energetically absorbed and the ratio $\frac{\text{CO}_2}{\text{O}_2}$ approaches unity.

The decomposition of lactic acid by yeasts in the presence of a hydrogen acceptor consists of, first, the separation of hydrogen by reductase with the production of pyroracemic acid and, secondly, the splitting off of carbon dioxide from the pyroracemic acid through the action of carboxylase, with the production of acetaldehyde. Since pyroracemic acid is considered to be an intermediate product of alcoholic fermentation, its production from lactic acid is considered to offer new proof that lactic acid is an intermediate product of alcoholic fermentation.

Decomposition of lactic acid by killed yeast. V. I. PALLADIN (W. PALLADIN) and D. A. SABININ (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6 ser., 1916, No. 3, pp. 187-194; *Biochem. Jour.*, 10 (1916), No. 2, pp. 183-196).—The authors endeavored to determine under what conditions the decomposition of lactic acid would produce alcohol instead of acetaldehyde. Methylene blue as ordinarily used for a hydrogen receptor was replaced by pyroracemic acid which, when decomposed by carboxylase, yields acetaldehyde. The data submitted, while not considered to prove conclusively that lactic acid is the intermediate product of alcoholic fermentation, are indicated as showing that alcohol does not present the result of decomposition but the product of reduction of acetaldehyde by removing the hydrogen from one of the intermediate products of the decomposition of glucose.

Investigations on the significance of hydrogen in alcoholic fermentation and respiration have shown that on the reductions depend the anaerobic oxidations. During the formation of the intermediate products in the molecule of glucose the hydrogen and not the oxygen is displaced. The chemical processes of alcoholic fermentation and respiration can not be explained by reactions of decomposition alone, as the hydrogen is displaced not only within the confines of one molecule but also passes from one molecule into another. Points in favor of the theory that lactic acid is an intermediate product in alcoholic fermentation are discussed.

The effect of alcohol and methylene blue on the formation of carbon dioxide by dead yeast, V. I. PALLADIN and E. I. LOVCHINOVSKAÏA (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1916, No. 4, pp. 253-256).—Experiments are reported, the purpose of which was to determine whether or not those plants which are able to oxidize alcohol under normal conditions may do so in the presence of a hydrogen acceptor with the formation of carbon dioxide.

The results obtained in general were negative. Preparations containing alcohol and methylene blue sometimes produced slightly more carbon dioxide than mixtures with alcohol alone. This small increase is attributed to the stimulation of the process of fermentation by the methylene blue.

On reductase of plants, V. I. PALLADIN, P. G. PLATISHENSKIÏ, and E. V. ELLADI (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1915, No. 4, pp. 309-326, fig. 1).—It is indicated that the process of reduction in living organisms is of much more general occurrence than any other enzymic process, and that a thorough knowledge of its mode of action is especially important for the correct conception of the process of respiration. Experiments carried on with seeds and sprouts of peas, wheat sprouts, and several preparations of yeast are described in detail. The progress of reduction was determined by comparison with control solutions of methylene blue.

Soaking was found to accelerate reduction in pea seeds considerably. An acceleration was also noted in pea sprouts, especially on the addition of potassium bicarbonate. It is considered to be quite possible that germination is accompanied by an increase in the amount of reductase.

Extracted yeast reduced methylene blue less easily than nonextracted. The reductase activity was paralyzed by autolysis. Boiled taka-diastase was found to act as a coenzyme, while the unboiled exerted no influence. Peroxidase inhibited the action of reductase.

Water was found indispensable for the activity of the enzyme, while glycerin, pyridin, alcohol, and formamid retarded its activity. Potassium hydroxid in moderate quantities greatly stimulated reduction, but in larger amounts retarded it. The action of calcium hydroxid was the reverse of that of potassium hydroxid, while magnesium oxid exerted a stimulative action. The presence of reductase in commercial diastase, taka-diastase, and emulsin was not determined with certainty.

It is indicated that the course of reduction depends on the amount of reductase and the substance to be oxidized, as well as on the amount of the hydrogen acceptor (substance to be reduced).

The action of peroxidase on chlorophyll, V. LÛBIMENKO (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1915, No. 11, pp. 1159-1170).—The author notes a recently discovered enzyme of green plants, provisionally named antioxidase, which paralyzes the oxidizing activity of peroxidase and thus protects chlorophyll from decomposition in the course of the process of assimilation. The action of the antioxidase ceases immediately on the addition of antiseptics which destroy the new enzyme, and rapid decomposition of chlorophyll follows.

The effect of the reaction of the medium on the activity of inulase of *Aspergillus niger*, A. KIZEL (KIESEL) (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 4. ser., 1915, No. 11, pp. 1077-1092, figs. 3).—The action of inulase extracted from the mycelium of *A. niger* on inulin obtained from dahlia roots was tested in the presence of sulphuric, hydrochloric, phosphoric, and acetic acids, sodium nitrate, disodium phosphate, disodium citrate, monosodium phosphate, and monosodium citrate.

A slight increase of the activity of inulase was noted in the presence of the acids, while a great activation was afforded by the acid salts, especially disodium citrate and monosodium phosphate. Alkaline salts, on the contrary, appeared to exert a harmful effect on the activity of the enzyme.

Studies of arginase and urease in plants. A. KIZEL (KIESEL) (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1915, No. 13, pp. 1337-1364).—Confirming earlier findings the author ascertained the presence of arginase and urease in *Aspergillus niger*, and also established the occurrence of the enzymes in ergot on *Secale cornutum*, in vetch (*Vicia sativa*), and in ripe fruits of *Angelica silvestris*, as well as the presence of urease in etiolated sprouts of the white lupine. In previous work the existence of arginase in the sprouts of the white lupine and both arginase and urease in meadow mushrooms had been established.

The enzymes of *A. niger* were found not to split guanidin tetramethylenamin, although there was a partial cleavage of tetramethyldiguanidin with the formation of guanidin tetramethylenamin. The enzymes found in ergot, meadow mushrooms, and vetch do not decompose either of these reagents. In the work with the enzymes of the ergot, guanidin also remained unchanged. In some experiments with the white lupine and red clover (*Trifolium pratense*), in which only tetramethyldiguanidin was used, no cleavage of the reagent was observed.

The experimental procedures used and the data obtained are described in detail.

Effect of medium on proteolytic enzymes of plants. V. I. PALLADIN (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd)*, 6. ser., 1916, No. 7, pp. 527-538).—Since proteolytic enzymes affect the activity of other enzymes, particularly the oxidases, the author attempted to determine experimentally substances which would check the action of the proteolytic enzymes but would not at the same time be harmful to the oxidative enzymes. Preparations of yeast and wheat sprouts served as experimental material, and sucrose, glycerin, ethylenglycol, pyroracemic acid, formalin, and sodium chlorid were tested as inhibitors.

Corroborative evidence was obtained in regard to the poisonous action of formalin on the proteolytic enzymes of yeast. A 1 per cent solution of pyroracemic acid neutralized by potassium hydroxid exerted practically no influence. The other substances were found to divide themselves into two groups, electrolytes and nonelectrolytes. Nonelectrolytes retarded the action of proteolytic enzymes in a manner proportionate to their concentration, while weak solutions of the electrolytes stimulated the action of proteolytic enzymes. A strong solution of sodium chlorid slightly inhibited the action, but in a much less degree than any of the nonelectrolytes.

It is concluded that the introduction of the harmless nonelectrolytes which arrest the action of proteolytic enzymes should have a beneficial effect on the action of the enzymes in alcoholic fermentation. Notwithstanding the fact that zymase may also be affected by nonelectrolytes, the formation of carbon dioxide is increased with the increase of concentration of these substances until an optimum of concentration is reached. Beyond this the nonelectrolytes may entirely inhibit the action of zymase.

Some auxoamylases. E. W. ROCKWOOD (*Abstr. in Proc. Iowa Acad. Sci.*, 23 (1916), pp. 37-39).—The author designates nitrogenous substances (particularly those containing an NH_2 group) which stimulate the activity of amylases as auxoamylases. In the work reported glycine, tyrosine, hippuric acid, anthranilic acid, and asparagine were found to be active, while sulphanilic acid and acid amides like urea, acetamide, and propionamide were inactive.

The effect of the amino acids as produced by digestive proteolysis on the pyrolytic enzymes is indicated. The work is being continued.

Quantitative microscopy, T. E. WALLIS (*Analyst*, 41 (1916), No. 489, pp. 357-5, fig. 1).—The author points out the common errors in the microscopical estimation for adulteration, and describes a method of general applicability which obviates the usual sources of error. As a standard for comparison in the new procedure, the author uses a suspension of lycopodium spores.

An improved method of determining solubility, W. S. HENDRIXSON (*Proc. U. S. Acad. Sci.*, 23 (1916), pp. 31-34, figs. 2).—A simple procedure for determining solubility, in which the solution is stirred by air which has been previously saturated with moisture at the temperature for which it is desired to determine the solubility, is described in detail. This saturation of the air compensates for the usual unavoidable loss by evaporation when the stirring is accomplished by air. The apparatus was used in connection with solubility determinations of acid sodium and acid potassium phthalates, which have been proposed by the author as standards in acidimetry and alkalimetry (E. S. R., p. 408).

Preparation of sulphurous acid, E. HART (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 3, p. 376).—For the preparation of small amounts of sulphurous acid for the laboratory the author recommends the warming of fuming sulphuric acid containing 30 per cent SO_3 with sulphur. Lump sulphur in not too large amount should be used. It dissolves in the acid and forms a blue solution from which, on warming, SO_2 mixed with some SO_3 is given off. If SO_3 is objectionable, the gas obtained can be absorbed, and the resulting solution boiled to obtain the SO_2 . The acid which remains is still fit for most uses. The value of the procedure, in view of the saving in copper, is considerable.

An improved nephelometer-colorimeter, P. A. KOWER (*Jour. Biol. Chem.*, (1917), No. 2, pp. 155-168, figs. 9).—The construction and manipulation of a new instrument, together with a simple and convenient lamp and lamp use, are described in detail. Advantages claimed for the new apparatus are a screw arrangement for changing the heights of the liquids, and, therefore, the elimination of lost motion inherent in racks and pinions; the elimination of dark cloth curtains; black one-piece glass plungers; fused one-piece nephelometric and colorimetric cups; and a convenient eye support.

The iodometric determination of sulphur dioxide and the sulphites, J. B. BOUSON (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 3, pp. 364-373).—The author briefly reviews the methods which have been used, and points out a number of sources of error.

For the very accurate determination of large or small amounts of sulphur dioxide the excess iodine method is recommended. When carbon dioxide and sulphur dioxide are to be determined in the same sample the sulphite method can be used to advantage. For the most accurate results it is indicated that the following conditions must be observed:

"The gas sample must not come in contact with even a trace of moisture prior to its reaching the absorbent. The analyzing apparatus must be free from rubber connectors when exact analyses of mixtures containing 10 per cent or more of sulphur dioxide are desired. For very accurate work it would be better to dispense with them entirely, although this source of error for mixtures containing less than 3 per cent of sulphur dioxide may be neglected. Mixtures of sulphur dioxide and air when dry do not react appreciably, but when moist a slow oxidation takes place. For this reason it is impossible to recover from a moist container, even by pumping, the initial amount of sulphur dioxide if a gas mixture has been in the container for any great length of time."

For the analysis of such soluble sulphites as anhydrous sodium sulphite the solution of the solid salt directly in an excess of an iodine solution containing sufficient hydrochloric acid and the determination of the excess iodine with thiosulphate is recommended. This procedure eliminates several sources of error, due to oxidation of the salt by agents other than the iodine solution.

The separation and estimation of butyric acid in biological products, I. I. K. PHELPS and H. E. PALMER (*Jour. Biol. Chem.*, 29 (1917), No. 2, pp. 199-205).—A method for the separation of butyric acid from formic and acetic acids by treating their barium salts with an excess of quinine sulphate, extracting the quinine butyrate with carbon tetrachloride, crystallizing, weighing, and identifying it by its melting point is described.

A table showing the melting point and approximate solubility in carbon tetrachloride of the quinine salts of formic, acetic, propionic, butyric, and sulphuric acids is submitted. The solubilities of the propionate and butyrate are so nearly the same that only a partial separation can be effected. The difference in the solubilities of the formate and propionate is, however, so much greater that their separation is effected easily.

Thiobarbituric acid as a qualitative reagent for ketohexose, G. P. PLASSANCE (*Jour. Biol. Chem.*, 29 (1917), No. 2, pp. 207, 208).—The author, at the Iowa Experiment Station, recommends the use of thiobarbituric acid as a test for ketohexoses as follows:

The sample to be tested is treated in a test tube with sufficient hydrochloric acid and water to bring the acid concentration to 12 per cent. The mixture is then heated to boiling, cooled under the tap, and a few drops of thiobarbituric acid solution (in 12 per cent hydrochloric acid) added. If a ketohexose was originally present an orange-colored precipitate forms on standing; if only aldoses were present the solution may become yellow but no precipitate results. It is indicated that barbituric acid can not be used in place of the thiobarbituric acid, as the condensation product is much more soluble.

Nitrogen in amino form as determined by formol titration, in relation to some other factors measuring quality in wheat flour, C. O. SWANSON and E. L. TATUM (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 3, pp. 482-491, figs. 5).—The authors, at the Kansas Experiment Station, have shown "that a comparatively large amount of nitrogen in amino form, as determined by the method of precipitation with phosphotungstic acid, is an indication of certain undesirable qualities in flour. These qualities in sound flour are of the same kind as those denoted by ash and acidity. Nitrogen in amino form, as measured by formol titration, is valuable together with the determination of ash and acidity in measuring quality in flour."

It is indicated, however, that titrable nitrogen is more uniformly distributed in the wheat kernel than are the materials which determine the amount of ash and acidity. In clear and low-grade flours, therefore, as compared with patent and straight flours made from the same wheat, the increase in titrable nitrogen is not proportional to the increase in ash or acidity.

Data relative to the ash, acidity, formol titration, and total nitrogen in 10-gm samples of mill streams, commercial patent flours, commercial straight flours, commercial clear flours, and commercial low-grade flours are submitted. They show that the lower grades of flour, such as the clear and low-grade, made from sound wheat, do not contain nitrogenous substances measured by formol titration in as large a proportion as ash and acidity.

See also previous notes (E. S. R., 30, p. 555; 33, p. 160.)

The amino-acid nitrogen content of the blood of various species, J. C. BOCK (*Jour. Biol. Chem.*, 29 (1917), No. 2, pp. 191-198).—Tabulated analytical data of the amino-acid nitrogen per 100 cc. of ox, calf, sheep, pig, cat, dog

chicken, duck, turkey, goose, human, and placental blood, and a number of pathological specimens of human blood, and in the whole blood, plasma, and organs of the calf, goose, chicken, and ox, are submitted, together with a detailed procedure for the determination of amino acids in blood. See also a previous note (E. S. R., 37, p. 14).

A rapid method for determining calcium in blood and milk, H. LYMAN *Iour. Biol. Chem.*, 29 (1917), No. 2, pp. 169-178).—Applying the principles previously used for determining calcium in urine and feces (E. S. R., 34, p. 508), slightly modified procedure is described for determining calcium in blood and milk. The method is simple and rapid and yields results accurate to within less than 1 per cent.

For the preparation of the calcium soap a reagent prepared as follows was used: Four gm. of stearic acid and 0.5 gm. of oleic acid are dissolved in 400 cc. of hot alcohol, 20 gm. of ammonium carbonate dissolved in 100 cc. of hot water is added, and the mixture is allowed to boil for a few moments. It is cooled and 400 cc. of alcohol, 100 cc. of water, and 2 cc. of ammonium hydroxide (specific gravity 0.9) are added, and then filtered. This solution should be perfectly clear and if well stoppered will keep indefinitely. Before using, this solution should be tested in the nephelometer for impurities. Since the introduction of 0.002 mg. of calcium in the course of the determination would result in an error of 1 per cent the importance of having reagents absolutely free from calcium is emphasized.

[Note on the Duclaux method] (*Dept. Landb., Nije. en Handel [Netherlands], Verslag. en Meded. Dir. Landb.*, No. 5 (1916), p. 12).—The importance of maintaining at 110 cc. the volume of the mixture being distilled after the removal of the 10 cc. fractions, especially where a mixture of several acids is being distilled, is pointed out.

The detection of small amounts of oxalic acid in wine, A. A. BESSON *Schweiz. Apoth. Ztg.*, 55 (1917), No. 7, pp. 81-85).—The author has thoroughly studied the method of Krels and Baragliola,¹ which consists of treating 1 cc. of the sample in the cold with 2.5 cc. of a 5 per cent calcium chlorid solution, 2.5 cc. acetic acid, and 5 cc. of a cold saturated solution of sodium acetate, allowing it to stand for 24 hours, and then centrifugalizing and examining the residue obtained. It is indicated that 0.01 per cent of oxalic acid can easily be detected by this procedure.

The results of the study show that the concentration of the reagents has a great influence not only on the crystal form of the precipitated oxalate but also on the delicacy of the test. A reagent consisting of a solution of 20 gm. of pure crystallized calcium chlorid in 250 cc. water to which 250 cc. of acetic acid and 500 cc. of a cold saturated solution of sodium acetate are added has been found to yield excellent results. Ten cc. of this reagent is used for a 10 cc. sample of the wine.

In the course of the study it was observed that in the samples containing oxalic acid, even in amounts as small as 0.01 per cent, there was no growth of mold, indicating the preservative action of the acid, at least in respect to molds. Certain samples which originally gave positive tests for oxalic acid yielded negative tests after several weeks. The oxalic acid thus appears to be destroyed in time. No explanation is given for this phenomenon.

Researches on the ultrafiltration of milk, A. BORRINO (*Arch. Ital. Biol.*, 64 (1915), No. 3, pp. 417-425).—After having experienced some difficulty in the ultrafiltration of milk through collodion membranes the author obtained a clear

¹ *Schweiz. Apoth. Ztg.*, 53 (1915), No. 29, pp. 397-400.

filtrate by passing the centrifugalized milk through an alundum filter. About 250 cc. of clear filtrate was obtained in two hours by this procedure.

Comparative analytical data relative to the specific gravity, electrical conductivity, freezing point, protein, lactose, ash (soluble and insoluble), chlorine, calcium, and phosphorus of the whole milk and filtrate (cow and human), and the probable combinations between the casein, calcium, and phosphorus in the residue from the filtrate of cow's milk are submitted in tabular form. It is concluded that in human milk as well as in cow's milk the lactose is not combined with the protein. A part of the calcium and phosphorus exists free in a dissolvable form. The calcium forms, not alone with the casein but also with the phosphoric acid and probably other anions, certain combinations which as yet have not been determined. These are retained by the filter and are probably to be regarded as nondissociable combinations, for the most part colloidal. In cow's milk a calcium-casein combination containing 2.4 per cent calcium oxid was determined.

In human milk the quantity of calcium and phosphorus in inorganic combination is relatively larger than that in cow's milk, representing more than one-half of the total calcium and phosphorus. In cow's milk the quantity represents less than one-third of the total.

A rapid and exact method for determining the diastatic activity of germinated grain, C. A. NOWAK (*Pure Products*, 13 (1917), No. 3, pp. 128-131).—The author describes in detail a rapid modified procedure which is considered to yield reliable results.

The soluble carbohydrate content of feeding stuffs as a guide in determining quality, G. B. VAN KAMPEN (*Cultura*, 27 (1915), No. 324, pp. 241-256).—The author briefly indicates that the results of a chemical and microscopical examination of feeding stuffs do not always yield the desired information in regard to the quality of the material.

The literature on the soluble and insoluble carbohydrates in normal and abnormal press cakes is reviewed. A procedure for determining soluble sugars polarimetrically before and after inversion is described and some experimental data submitted and discussed. While the data are considered to be only preliminary and it is deemed hardly possible to define any definite limits for sugar content of normal and abnormal samples because of the small amount of data available, the following percentage contents of sugar (calculated as sucrose) are considered normal for samples of first-grade material: Coconut cake, 17.5; soy bean cake, 13; peanut cake, 12; cottonseed meal, 7; linseed meal, 5; palm nut cake, 3.5; and sesame cake, 3.

Cane juice clarification, C. W. HINES (*Philippine Agr. Rev.* [English Ed.], 9 (1916), No. 4, pp. 339-347).—This is a general discussion of the common clarifiers used in cane sugar manufacture, as well as some special trade clarifiers.

Normal fermentation of sauerkraut, L. A. ROUND (*Jour. Bact.*, 1 (1916), No. 1, p. 108).—The author has studied the fermentation of sauerkraut in two factories, in the first making microscopical and chemical examinations and in the second a bacteriological study.

It was found that bacteria alone were concerned with the fermentation proper. Wherever air came in contact with the material, as at the top of the vat, yeasts grew rapidly and produced a heavy foul-smelling scum which destroyed the acid. A vat just being filled showed the presence of 5,000,000 organisms per cubic centimeter, 80 per cent of which fermented glucose and the remaining 20 per cent being mainly yeasts. The rate of growth of bacteria and the rapidity of fermentation were found to vary directly with the temperature, being much slower in cold than in warm weather. After reaching a maximum.

number of bacteria gradually decreased until at the end of five weeks between 4,000,000 and 10,000,000 viable organisms were present. Vats showing abnormal fermentation contained a different class of organisms. Fermentations in properly salted vats were found to be due to the growth of favorable organisms during the first few days before the normal acid flora had been able to establish itself and produce sufficient acid to stop decomposition. A slight increase in temperature was found in the course of normal fermentation.

METEOROLOGY.

Relation of weather to crops and varieties adapted to Arizona conditions *Arizona Sta. Bul. 78 (1916), pp. 45-118, pl. 1, fig. 1*.—"This publication is a thorough revision of Bulletin 61 (E. S. R., 22, p. 418). The arrangement and much of the body of the publication are essentially the same, but considerable new matter has been added, and information concerning the various crops and their adaptability to different parts of the State has been revised in accordance with new developments and the added experience of the past several years. This information has been secured from records which have been accumulating at the experiment station farms, and from personal visits and correspondence of different members of the station staff throughout the State."

The records upon which the bulletin is based have now covered a period of twenty years. The bulletin deals briefly with methods of keeping weather records; factors influencing results; general effects of temperature, direct sunshine, and dry and rainfall; and more in detail with varieties of crops which have proved most suitable to different sections of the State, arranged alphabetically for convenient reference and also with reference to the months in which they could be planted and when they mature.

Native vegetation and climate of Colorado in their relation to agriculture, W. ROBERTS (*Colorado Sta. Bul. 224 (1917), pp. 3-56, pls. 4, figs. 16*).—"This bulletin is an outgrowth of a number of years of observation and study of the native vegetation of Colorado in its relation to climate and to agriculture" supplemented by a reconnaissance survey especially of the west middle portion of the State during the summer of 1916, which was undertaken "for the purpose of testing conclusions arrived at and finding new relations."

In this study little consideration has been given "to the question of the value of native plant life as an indicator of the local physical conditions of the environment. Such detailed study, however, is of much practical importance, and is planned to engage in such a study later. But the attempt here is to point out the broader relations between our large native plant associations and the principal climatic factors under which they are growing, and to show their relation, in a very general way, to Colorado agriculture." Data, original and compiled, on temperature of the surface of the plant, air, and soil, with different altitudes, slopes, and other conditions; length of frostless season and effects of frosts and freezes; amount and distribution of precipitation under varying conditions; humidity; and sunshine, are presented and discussed.

The following large communities of Colorado native plants, with their climatic and agricultural relations, are discussed: (1) Grass-steppe or short-grass-land (Great Plains); (2) shrub-steppe—sagebrush, greasewood, rabbitbrush, etc.; (3) chaparral or brushland (thicket)—oakbrush, buckbrush, willow, etc.; chokeberry, thornapple, mountain mahogany, etc.; (4) coniferous woodland—pinyon pine and juniper woodland; (5) coniferous forests—(a) yellow pine-Douglas fir forest, (b) white fir forest, (c) lodgepole pine forest, (d) Engelmann spruce-balsam fir forest."

The grass-steppe is stated to be "a vegetative response to a low, infrequent rainfall, the greater percentage (approximately 75 per cent) of which comes during the growing season, and about 60 per cent of which is during the four months, June, July, August, and September." The average annual temperature for the steppe area ranges from 45 to 56° F. The relative humidity is generally low, from about 50 to 55 per cent. The grass-steppe is indicative of temperature conditions favorable to a varied agriculture when sufficient moisture is supplied.

The shrub-steppe, which is scattered throughout the entire Intermountain area, and occupies nearly 25 per cent of the area of the State, is as a rule representative of good general farming and orchard lands. The most important and by far the most extensive vegetation of the shrub-steppe is sagebrush, which is the characteristic type of vegetation of the well-drained, nonalkaline arid districts of western Colorado. Types of shrub-steppe vegetation of secondary importance are greasewood and rabbitbrush, which cover the larger part of San Luis Valley and limited areas in other parts of the State. Greasewood is not indicative of any particular set of climatic factors, but is a response to local soil conditions. It is, however, almost always an indication of a high water table and consequently of soil rich in alkali. "The round-leaved saltbush (*Atriplex confertifolia*), sometimes along with greasewood (*Sarcobatus vermiculatus*), and common Grayia (*Grayia spinosa*), is found chiefly on alkaline flats in western Colorado, especially in the lower valleys. Extensive and typical areas of this association are found in the lower Snake River Valley. The soil it occupies is usually fine-grained, the surface layers dry, and the soil below the first and second foot quite high in salt content. Salt sage or small saltbush (*Atriplex nuttallii*) is another plant of alkaline flats."

Scrub oak forms the most extensive growth of chaparral or brushland and grows under a wide range of climatic conditions as found between 4,000 and 9,000 ft. It is frequently associated with huckbrush, and both usually occupy deep rich soil. Scrub oak forms are seldom found above the limit of successful growth of alfalfa, potatoes, small grains, strawberries, hardy can fruits, and the hardy vegetables.

The pinyon pine-Juniper woodland zone is confined to a region of which the mean annual precipitation is uniformly under 15 in. It is an index "of temperature conditions which permit the growth of all but the tenderest fruits, all the small grains, flax, sugar beets, potatoes, alfalfa, and the garden vegetables, excluding melons. In the lower part of the belt peaches, sweet cherries, melons, and other tender crops yield bountifully. Much valuable orchard land of Colorado is cleared pinyon pine-Juniper soil."

Yellow-pine forests seldom show typical development in areas having less than 15 in. of precipitation annually. Its altitude ranges approximately from 6,000 to 8,000 ft. in northern Colorado and 7,000 to 9,000 ft. in southern Colorado. A large percentage of the area of growth of this plant is so steep and stony as to be economically adapted only to grazing and timber growing. Yellow-pine forest indicates temperature conditions favorable to the maturing usually of wheat, oats, barley, and rye, and is well suited to alfalfa, potatoes, and the hardier vegetables, cane fruits, and strawberries.

"Lodgepole pine, as a strongly developed plant association, indicates temperature conditions too low for the maturing of the small cereals, for the profitable growth of alfalfa, potatoes, peas, and any but the most hardy vegetables." The same is true of the white-fir forest zone. Engelmann fir occupies a region of nonagricultural climatic conditions.

Weather conditions, 1911-1916 (*Minnesota Sta., Rpt. Crookston Substa. 1910-1916, pp. 14-19*).—Tables are given which show the precipitation by months and the dates of the latest killing frost in the spring and the earliest

in the fall at Crookston, Minn., from 1897 to October 1, 1916, and summaries of observations on temperature, precipitation, clear and cloudy days, and prevailing winds during the same period. The average date of the earliest killing frost was September 24, the average growing period being 127 days.

SOILS—FERTILIZERS.

Soil survey of New Castle County, Delaware, T. M. MORRISON, W. D. SEWELL, and O. I. SNAPP (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 34, fig. 1, map 1*).—This survey, made in cooperation with the Delaware Experiment Station, deals with the soils of an area of 278,400 acres in northern Delaware, two-thirds of which lie in the Coastal Plain and one-third in the Piedmont Plateau. The surface includes a smooth to rolling plain in which drainage is not yet thoroughly established, and a well-drained and deeply dissected plateau.

Including tidal marsh and meadow, 16 soil types of six series are mapped, of which the Sassafras silt loam and loam and the Chester loam cover 26.5, 12.4, and 11.9 per cent of the area, respectively.

Analyses of soils of Habersham County, W. A. WORSHAM, JR., D. D. LONG, L. M. CARTER, and M. W. LOWMY (*Bul. Ga. State Col. Agr., No. 114 (1917), pp. 40, figs. 5*).—This report is intended to supplement the physical survey of the soils of the county made in cooperation with the Bureau of Soils of the U. S. Department of Agriculture, and contains data on the chemical composition of both the surface soil and subsoil of the various soil types found in the county.

"Taking the average of all soils of the county, analyses show the plant food content to be as follows: Nitrogen, 0.0425 per cent; phosphoric acid, 0.0016; and potash, 1.0126. Nitrogen and phosphoric acid are relatively low in the average soil of the county. Nitrogen is lowest, and, without doubt, the limiting factor of crop production."

Bremer County soils, W. H. STEVENSON, P. E. BROWN, and F. B. HOWE (*Iowa Sta. Soil Survey Rpt. 1 (1917), pp. 43, pl. 1, figs. 11*).—This is the first of a series of reports on the soils of Iowa, and supplements the survey made in cooperation with the Bureau of Soils of the U. S. Department of Agriculture (*E. S. R., 32, p. 317*).

Analyses of samples of the soils taken at depths of 6½ in., 6½ to 20 in., and 20 to 40 in., are reported. "These results, as a whole, show that the soils of Bremer County are not so richly supplied with necessary plant food as to assure abundant crop growth continuously. . . . In general the application of phosphorus, the increase of humus and of nitrogen, and the addition of limestone are needed to make the soils of the county permanently fertile. Other essential elements are apparently present in sufficient amounts for many years to come."

General information regarding the principles of permanent soil fertility and the results of greenhouse tests of some of the prevailing soil types of the county are included.

Soil survey of Richardson County, Nebraska, A. H. MEYER, P. H. STEWART, and C. W. WATSON (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 36, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 348,800 acres in southeastern Nebraska, the topography of which is in general rolling. The surface drainage is considered to be adequate. The county lies almost entirely within the glacial and loessial region, with only a small area belonging to the river flood plain province.

The soils include upland, terrace, and first bottom soils. Including river wash and rough stony land, 14 soil types of nine series are mapped, of which

the Carrington silt loam, Wabash silt loam, and Marshall silt loam cover 46.5, 19.6, and 16.5 per cent of the area, respectively.

Soil survey of Hamilton County, Ohio, A. L. GOODMAN, E. R. ALLEN, and S. W. PHILLIPS (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the Ohio Experiment Station, deals with the soils of an area of 260,480 acres in southwestern Ohio, the topography of which ranges from level or nearly flat to hilly, ridgy, and rough. Drainage in general is said to be well established.

The soils consist of upland, terrace, and bottom land. "The soil-forming material is complex in origin as well as in mode of accumulation. It is partly glacial drift or till, partly residual material left in the decay of limestone and calcareous shales, partly a smooth, silty material whose origin is not thoroughly understood, and partly alluvium." Seventeen soil types of ten series are mapped, of which the Cincinnati silt loam and the Fairmont silty clay loam cover 38 and 24.8 per cent of the area, respectively.

Agricultural possibilities of Ohio peat soils, A. DACHNOWSKI (*Jour. Amer. Peat Soc., 9 (1916), No. 1, pp. 10-21*).—This is a report of rather general observations on the necessary fertility treatment of Ohio peat soils, including cultivation, liming, fertilization, drainage, and cropping. It is concluded that "the essential objects are, aside from more effective organization, an increase in smaller farms, a greater use of fibrous soils for pasture, meadow, or general livestock farming, and more intensive farming and greater specialization upon the better, suitable types of peat and muck."

Study of the vine-growing soils of Vevey [Switzerland], I. ANKEN (*Ann. Sci. Agron., 4. ser., 5 (1916), No. 1-6, pp. 1-156, pls. 3, figs. 4*).—This is the report of a survey of the geology, origin, mineralogy, and mechanical, physical, and chemical composition of the vine soils of the district of Vevey on the northern shore of Lake Geneva in Switzerland.

The soils of Southern Rhodesia and their origin, H. B. MAUFE (*Rhodesia Agr. Jour., 14 (1917), No. 1, pp. 8-23*).—The soils of Southern Rhodesia are discussed as red clay, granite, sandy, and black soil, and mechanical analyses of samples of the last three are given. It is stated that the soils of the regions are mainly the result of the decomposition of rocks and that clayey matter consisting of hydrated aluminum silicates is the chief product of that decomposition.

The soil mulch, L. E. CALL and M. C. SEWELL (*Jour. Amer. Soc. Agron., 9 (1917), No. 2, pp. 49-61*).—Experiments conducted at the Kansas Experiment Station, in which moisture determinations were made to a depth of several feet on cultivated and uncultivated, uncropped areas, kept free from weeds, are reported.

The results are taken to indicate that "a cultivated soil is no more effective than a bare uncultivated soil in preventing evaporation. Cultivation conserves soil moisture by the elimination of weeds and by preventing run-off. The development of nitrates may be as extensive without cultivation as with cultivation."

Relation between indications of several lime-requirement methods and the soil's content of bases, C. J. SCHOLLENBERGER (*Soil Sci., 3 (1917), No. 3, pp. 279-288, figs. 3*).—Laboratory experiments conducted at the Ohio Experiment Station on two soils well supplied with basic material other than carbonates and data obtained from analyses of soil from the 5-year rotation fertility experiment plots at the station are reported. The soils were neutral clay loam deficient in organic matter, alkaline black clay, and acid silt loam.

"Experiments upon acid-extracted and washed soils and upon field-treated soils demonstrate that the vacuum method is, of the number studied, the most nearly quantitative method which is at the same time universally applicable.

the idea of determining the percentage of total lime requirement satisfied is offered as a means of comparing the condition of basicity of different soils and as an aid in the solution of other soil problems. The limited amount of experimental data available indicates that there may be some relation between the percentage of total lime requirement satisfied and the reaction of the soil to litmus, carbonates being practically absent. Crop yields in pot experiments have not indicated that an application of precipitated calcium carbonate, according to the indications of the vacuum method, which is considered to represent saturation with calcium, is harmful in other than exceptional cases."

Four references to literature bearing on the subject are appended.

The effect of some acids and alkalis on soil bacteria in the soil solution, O. M. GRAVIER (*Soil Sci.*, 3 (1917), No. 3, pp. 289-295, figs. 2).—This is an abstract of a thesis, in which experiments conducted at the Michigan Agricultural College on solutions extracted from rich, sandy loam and sandy soils are reported.

"The solutions were adjusted to various degrees of reaction with N/100 sodium hydroxide and hydrochloric acid, methyl red being used as an indicator for titration, and 10-cc. quantities were placed in 100 gm. of pure sterile quartz sand. The moisture content of the cultures was adjusted about every ten days. The counts of bacteria in the soil solution were made upon sodium asparaginate agar after seven days of incubation at a temperature varying between 19 and 23° C."

It was found that "the development of the general flora of the soil bacteria from sand and sandy loam soils, when studied in the soil solution of sand cultures, was retarded if the reaction of the medium had a higher OH-ion concentration than N/1,000. The development of soil bacteria was inhibited when the reaction of the medium became neutral. The H-ion concentration of N/1,200 hydrochloric and sulphuric acids was germicidal to about 99.2 per cent of soil bacteria. . . . With H-ion concentration of N/2,164 the rate of multiplication of soil bacteria from sandy loam corresponded to the rate of destruction so that there was no change in the total number of bacteria. The H-ion concentration of N/2,840 inhibited the growth of 43 per cent of soil bacteria when compared with the growth of soil bacteria in the medium with N/412 OH-ion concentration. The reaction of alkaline cultures was gradually neutralized and later became acid. When the 'toxic limit' of acids toward Indian corn seedlings was compared with the toxic limit of about the same concentration of the same acids on the general flora of the soil bacteria from sand and sandy loam soils, the soil bacteria were injured to the extent of 43 per cent."

Twenty references to literature bearing on the subject are appended.

A review of investigations in soil protozoa and soil sterilization, N. KOPPELLOFF and D. A. COLEMAN (*Soil Sci.*, 3 (1917), No. 3, pp. 197-269).—This paper is intended to be a survey of the subject to date and includes a list of 337 references to literature bearing on the subject.

The ecological significance of soil aeration, W. A. CANNON and E. E. PAGE (*Science*, n. ser., 45 (1917), No. 1156, pp. 178-180).—Experiments conducted by the Carnegie Institution of Washington and Johns Hopkins University are reported, which show "that different species of plants may differ markedly in their response to variations in the composition of the soil atmosphere, and hence to changes in soil aeration. The effects of diminution of oxygen are manifest and the results with *Opuntia* indicate a direct and specific effect of carbon dioxide in addition to the effect of the dilution of the oxygen."

It is pointed out that "although deficiency in aeration has frequently been suggested as an agricultural difficulty, or as the reason why certain species do not grow upon soils of heavy texture, it does not appear that this suggestion

has had any exact experimental basis. Nor does it seem to have been appreciated that different species may have great differences in the oxygen requirement of their roots and widely variant responses to differences in soil aeration, responses which appear to be quite as specific and significant as the responses to temperature and to available water which form the present basis of ecological classification."

Reclaiming the waste, P. A. GRAHAM (London: *Country Life, Ltd.*; New York: *Charles Scribner's Sons*, 1916, pp. XIII+175; rev. in *Country Life* [London], 41 (1917), No. 1050, pp. 149, 150).—This book is a number of the so-called "Increased Productivity Series." Its object is "to direct attention to the vast possibilities of waste land reclamation in Great Britain and Ireland." It contains the following chapters:

The urgency of land reclamation; reclaiming a Norfolk heath (March 9, 1916); reclaiming a Norfolk heath—four months' progress (July 12, 1916); the weeds of a Norfolk heath, by Brenchley; how to hold reclaimed waste; nowt but bracken and fuzz; how much reclaimable waste is there; sand dunes and coast erosion; poverty bottom—a lesson from downland; reclamation of waste land in Holland; reclamation in Holland—a colonial minister's experience; making farms out of moorland; fish ponds and reclamation; reclamation in Belgium, by H. Vendelmans; a war of timber; afforestation of peat bogs and sand dunes, by A. Henry; planting on the South Downs, by Somerville; reclaiming the pit bank; labor and reclamation; forestry and reclamation; and the industrialization of land in France, by Souchon.

The apparent main purpose of this book is to outline ways and means of meeting war-time conditions in England.

Summaries of soil fertility investigations, A. T. WIANCKO and S. C. JONES (*Indiana Sta. Bul.* 198 (1917), pp. 3-20).—This bulletin presents in a condensed form the principal results obtained up to the present time from the use of lime, legumes, manure, and various commercial fertilizers upon seven outlying experiment fields and upon one of the older series of plats on the university farm.

Excluding two fields which have been under treatment only one year, the following results have been secured from the principal treatments: With ground limestone the profits have ranged from \$3.31 to \$18.34 per acre per rotation, and with manure from \$1.62 to \$4.45 per ton per rotation. On limed land mixed fertilizers have been used at a profit in all cases. At North Vernon (Jennings Co.) and Worthington (Greene Co.), where fertilizers were applied to wheat on manured land, good wheat increases were secured with a 200-lb. application of a fertilizer carrying 2 per cent nitrogen, 8 per cent phosphoric acid, and 4 per cent potash following corn, which had received 6 tons of manure and 200 lbs. of acid phosphate per acre.

Rock phosphate without manure has yielded profitable returns at Scottsburg (Scott Co.) and Wanatah (Laporte Co.). With manure it has been profitable at North Vernon and Worthington, while at Scottsburg and South Bend (St. Joseph Co.) it has been used at a loss. Acid phosphate, with or without manure, has shown large profits in all cases, and per dollar invested has been the most profitable fertilizer treatment either alone, with lime, or with both lime and manure.

Clover in place of timothy in rotation with corn and wheat has increased the value of the rotation by \$3.07 at North Vernon and \$7.90 at Worthington, where no fertilizer was used. On fertilized land the legume has increased the value of the rotation by \$12.50 and \$5.08, respectively, after paying for the fertilizer.

Why Illinois produces only half a crop, C. G. HOPKINS (*Illinois Sta. Circ.* 193 (1917), pp. 3-16).—In this address before the Illinois State Farmers' Institute, at Streator, February 21, 1917, the author analyzes the Illinois crop

yields and reviews experimental data relative to increased yields due to improved soil fertility methods.

It is concluded that both the average acre-yields and the average acre-values of the most common Illinois crops (corn, oats, wheat, and clover) on the most common Illinois soil can be doubled by the adoption of better crop rotations, including a more liberal use of legumes, with a return of more organic manures, together with a systematic application of limestone and phosphorus in the form of raw rock phosphate but without commercial potassium or commercial nitrogen.

Live stock and the maintenance of organic matter in the soil, E. O. FIPPER (*Jour. Amer. Soc. Agron.*, 9 (1917), No. 3, pp. 97-105, fig. 1).—This is a review and summary of the results of work by others at several of the State experiment stations, from which the following conclusions are drawn:

"The higher plants are able to use organized carbonaceous foods, both nitrogenous and nonnitrogenous. Carbonaceous food conserves energy in the process of growth of the crop and makes possible a larger total growth in a given time. The organic matter in the soil is the direct source of the carbonaceous material used by the plant. Any process that permits the destruction of organic matter that might find its way into the soil is likely to be poor economy.

"Animals destroy from half to nine-tenths of the organic matter in the feed consumed. It is burned up in the body processes and expended as energy. A further large loss occurs in the handling of the manure.

"It is entirely possible to maintain the organic matter in the soil without animal husbandry. On very poor soils, animal husbandry may be bad practice. It may be justified by large profits from the animal products by means of which the loss of organic matter can be made up from other sources."

The manual of manures, H. VENDELMANS (*London: Country Life; New York: Charles Scribner's Sons*, 1916, pp. XVI+164, figs. 6).—This is a number of the so-called "Increased Productivity Series," and its purpose is to give practical information on manures and fertilizers and their proper uses. A discussion of manures in general is followed by specific information regarding nitrogenous, chemical, phosphatic, and potassic manures, ashes and soot, magnesia and silica, and organic manures of different kinds. Materials for soil improvement, including lime-containing compounds, are also discussed, and final sections deal with auximones and the quantities of manures to be used per acre.

The text of the English fertilizers and feeding-stuffs act is also given.

Fertilizers and their supply in war time, J. A. VOELCKER (*Jour. Roy. Soc. Arts*, 65 (1917), No. 3356, pp. 324-337).—The purpose of this paper is to summarize the present general agricultural requirements in England in regard to fertilizers as consisting in the supply of superphosphate and basic slag as phosphatic manures and of ammonium sulphate as the nitrogenous one. "The supply of these three is all essential, and if farmers are to meet successfully the demands now made on them, it is all important that they should be put in the way of obtaining an adequate and ready supply of these."

Artificial manures.—Experiments on their value for crops in western India, H. H. MANN and S. R. PARANJPE (*Dept. Agr. Bombay Bul.* 76 (1915), pp. 55).—This bulletin gives the results of a number of fertilizer experiments with various crops in western India, where commercial fertilizers have not proved popular heretofore. The crops were divided into field crops, which included tobacco, potatoes, wheat, cotton, and sugar cane, and garden crops, which included chillies, onions, alfalfa, and bananas.

A general conclusion which seems applicable to all districts alike is that where irrigation is not practiced an application of commercial fertilizers is not so profitable as the fertilizing methods already in practice. The use of acid phosphate on the black soils of western India gives good results, providing there is a considerable quantity of organic matter present in the soil.

[Fertilizer experiments], P. LIECHTI (*Landw. Jahrb. Schweiz*, 30 (1916), No. 5, pp. 506-508).—Mixing liquid manure with peat dust was found not to prevent the escape of ammonia from the liquid manure.

Experiments with oats on an acid sandy loam soil, to compare samples of lime nitrogen from five different sources, showed that in one case the effect of the lime nitrogen was injurious. Analyses of samples of this lime nitrogen showed the presence of appreciable quantities of dicyandiamid, which is thought to explain the injurious action:

Incomplete experiments with urea on oats are also reported.

Standardization of humus used for fertilizer, J. H. HOFF (*Jour. Amer. Soc.*, 10 (1917), No. 1, pp. 18-22).—It is the author's opinion, based on a review of work by himself and others, that the important factors in properly judging the manurial value of muck and peat are (1) natural productivity, (2) reaction and freedom from excess moisture, (3) whether high in nitrogen and whether the other fertility elements are properly balanced and proper bacterial flora prevail, and (4) solubility.

The organic nitrogen compounds of soils and fertilizers, E. C. LATHROP (*Jour. Franklin Inst.*, 183 (1917), Nos. 2, pp. 169-206; 3, pp. 303-321; 4, pp. 465-498).—This article summarizes the results of investigations, partly reported elsewhere (*E. S. R.*, 32, p. 217; 36, p. 25), which were undertaken to determine the origin, chemical composition, biochemical changes, and distribution of organic nitrogenous substances in the soils, as well as the action and availability of the nitrogen of soils, peats, and organic fertilizers. The investigations of others, as well as of the author, are reviewed, and an extensive bibliography of the subject is given. The studies were made with a large number of soils from widely different regions. The methods employed are fully described.

The author concludes that "histidin, hypoxanthin, cystosin, xanthin, nucleic acid, creatinin, cyanuric acid, or its isomer cyamelid, may be considered to be organic nitrogenous constituents commonly occurring in soils. Arginin, lysin, adenin, cholin, [and] trimethylamin may be considered at the present time to be nitrogenous constituents unusual to soils, inasmuch as they occur infrequently in soils. These compounds may either not be normally formed by the processes of change taking place in the soil or if they are formed they are probably very quickly changed into other compounds, for example, arginin into ornithin and urea or adenin into hypoxanthin."

Studies were made of the nitrogenous compounds of natural and processed organic fertilizers. In the first nitrogen was found to be present in the form of ammonia, melalanin, cystin, arginin, histidin, lysin, monoamino compounds, and nonamino compounds. In the second there were found arginin, histidin, lysin, leucin, tryosin, guanin, and hypoxanthin. The conclusion was reached that "the process by which the nitrogen of certain trade wastes, such as hair, leather, garbage, etc., is made more available is recognized as a process of partial hydrolysis of the complex proteins contained in such materials resulting in ammonia, amino acids, etc., all of which are more readily available than the original protein materials. This hydrolysis is almost complete, the nitrogenous compounds formed being principally the primary products of protein hydrolysis, together with a small amount of protease-like compound which has not been fully decomposed. . . . The more extended and final the hydroly-

ysis the more available the nitrogen of the compounds formed, since, as has been shown, the final products of hydrolysis are utilized by the plants as such and are at the same time more readily changed into ammonia by soil organisms than are the intermediate compounds produced by partial hydrolysis."

Sources of nitrogen compounds in the United States. C. G. GILBERT (*U. S. Senate, 64. Cong., 1. Sess., Doc. 471 (1916), pp. 11; abs. in Nature [London], 98 (1917), No. 2466, pp. 431, 432*).—This is an article on the natural occurrence of nitrogen and its adaptability to use, especially as a fertilizer. In summarizing the situation it is stated that "the evolution of a practicable process for the oxidation of by-product ammonia to render present resources available, with the development of an atmospheric nitrogen fixation output by the cyanamid process carefully timed to meet growing demands following a reduction in the retail price of nitrogenous fertilizer, would appear to be the desirable governmental procedure as being the one least liable to disastrous consequences."

The nitrate industry. E. CUEVAS (*New York: W. S. Myers, 1916, pp. 61, pls. 3, figs. 4*).—This is a paper presented at the second Pan American Congress at Washington, D. C. It gives a brief history of the Chilean nitrate fields and describes in detail the character and composition of the nitrate deposits as well as the methods of mining and preparing the material for industrial purposes.

The author is of the opinion that the deposits are capable of supplying the needs of the world for at least 300 years. It is suggested that as a matter of national preparedness, from both the military and the purely agricultural standpoint, the United States should proceed at once to buy and store large quantities of the nitrate.

In an introductory note by the publisher, attention is called to the fact that "the Central Empires of Europe imported from Chile in the five years ended December 31, 1914, an unheard of tonnage of nitrate of soda, amounting to about 5,000,000 tons. The area of the Central Empires is hardly greater than the combined areas of California and Texas. These empires imported more than all the rest of Europe for the period named. It is not improbable that a very great amount of this 5,000,000 tons is still held in reserve in Germany, and it is privately reported that no Chilean nitrate is to be permitted to be used in agriculture for some time to come."

When are summer crops to be fertilized with lime nitrogen? P. WAGNER (*Drut. Landw. Presse, 43 (1916), Nos. 18, pp. 149, 150; 19, pp. 158, 159*).—Data relating to the time of fertilizing summer crops with lime nitrogen, obtained from numerous experiments carried on at different stations, are reported.

It is concluded that it is not necessary to apply lime nitrogen to loam and clay soils previous to seeding time. On heavy soil the ground should be worked with a harrow as early as possible and lime nitrogen applied and thoroughly mixed with the soil just prior to seeding. Better results were obtained by applying all the lime nitrogen just prior to seeding than by applying a part as a top-dressing.

Fertilizer experiments (*Minnesota Sta. Rpt. 1916, pp. 58, 59*).—The results of several years' fertilizer experiments at the different Minnesota experiment farms are taken to indicate "that the experiment station is not justified in recommending the use of phosphates in general farming operations in this State."

Phosphate rock. R. W. STONE (*U. S. Geol. Survey Bul. 666-J [1917], pp. 4*).—This is a brief review of the phosphate rock resources of the United States and includes data on production. It is stated that the total output for 1916 was 1,980,000 tons, valued at \$5,897,000.

Potash in agriculture, B. C. ASTON (*Jour. Agr. [New Zeal.]*, 11 (1915), No. 4, pp. 283-295, figs. 3; 13 (1916), No. 6, pp. 446-454).—This is a review of the natural sources of potash in New Zealand, from which it is concluded "that only for special crops, such as potatoes, garden crops, mangels, and a few other potash-loving crops, are New Zealand soils immediately in need of potash manuring, and it is with these crops and with reclaimed swamps deficient in potash that experiments might be instituted to determine whether the deficiency may be economically supplied by resources available in the Dominion. Researches having as their object the extraction of potash with a view to its export might well give place to others having a greater prospect of economic success."

The volatilization of potash from cement materials, E. ANDERSON and H. J. NESTELL (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 3, pp. 253-261, figs. 13).—

The results of an extended series of investigations on potash volatilization from silicate mixtures are reported, which are taken to indicate that "the potash in any cement material can all be volatilized. The determining factors in this reaction are temperature and the length of time exposure of the cement material to the temperature and gas volume prevailing. The lower limit of temperature for potash volatilization is 1,100° C., and the rate of volatilization increases rapidly with the temperature.

"The presence of chlorids, particularly calcium chlorid, increases the velocity of the volatilization, while sulphates decrease this rate. Because of the formation of sulphates, sulphur dioxide in the furnace gases retards the volatilization. Sodium is driven off nearly as easily as is the potassium.

"In the kiln, besides the factors of time and temperature, the size of the clinker also affects the volatilization rate. The smaller the clinker the better the volatilization of potash from it.

"Although the potash in any cement mix can be driven off, the rate of expulsion at any given temperature varies for different materials, and is probably dependent on the mineralogical character of the potash-bearing component of the cement material."

Growing crops without potash in 1916, C. D. WOODS (*Agr. of Maine*, 1913, pp. 293-307).—This paper is a reprint of that previously noted (E. S. R., 32, p. 325).

Lime in agriculture, E. A. FELDER (*S. C. Dept. Agr., Com. and Indus., Bul.* 59 (1917), pp. 75, figs. 2).—This bulletin is intended to be a complete treatise on the subject, discussing the varied forms of agricultural lime and their uses, sources of supply, and the relative values of limestone, shell lime, calcined marl, and noncaustic, dried phosphomarl in South Carolina agriculture. It is stated that liming is the greatest need of South Carolina agriculture and that marl is the greatest undeveloped asset of the State in this respect. Special attention is given to the intelligent use of lime.

Forms of agricultural lime and their application, M. L. FRANKOW (*Nat. Lime Manfrs. Assoc., Agr. Bul.* 3 (1917), pp. 16).—This pamphlet deals with ground limestone, quicklime, and hydrated lime with reference to their advantages and disadvantages for agricultural use, pointing out especially the conditions under which each may best be used.

The relation of lime to agriculture, L. B. BROUGHTON (*Md. Agr. Ext. Serv. Bul.* 2 (1916), pp. 25-56).—This bulletin discusses different lime-bearing compounds and their physical, chemical, and biological effects on soil, and summarizes the results of experiments at the Maryland Experiment Station on the effect of lime in increasing crop production.

The summarized results are taken to indicate that "physically even a small amount of lime carbonate by its solubility in the carbonated soil water will act

beneficially in causing the flocculation of clay and in the subsequent conservation of the flocculent or tilth condition, by acting as a light cement holding the soil crumbs together when the capillary water has evaporated, thus favoring the penetration of both water and air, and of the roots themselves. Among the most important chemical effects are, by neutralizing the soil acidity, the maintenance of fertility is raised; by maintaining the proper degree of moisture and earth bacterial life is enhanced, especially that of nitrification, also the development and activity of root bacteria of legumes and other nitrogen-gathering bacteria; the rendering available, directly or indirectly, of relatively small percentages of plant food, notably phosphoric acid and potash."

The text of the Maryland lime-grinding bill is included.

The question of lime fertilization. P. LIECHT and E. TRUNNINGER (*Landw. Jahrb. Schweiz*, 50 (1916), No. 5, pp. 480-488, figs. 2).—Experiments on the influence of liming on soil fertility are reported, and the conclusion drawn that more attention should be given to the size of the grains of calcium carbonate used for fertilizing purposes. It is thought that the use of the finest ground calcium carbonate is not justified in all cases, but that coarse calcium carbonate could be used where experience has shown that the soil fertility is injured by excessive liming or by a liming which is quickly effective. It is believed that the use of coarser ground lime a more uniform distribution on the soil can be obtained, and that more can be used without injuring soil fertility.

Liming the land.—Decomposition and utilization of limestone in soil. W. AMES and C. J. SCHOLLENBERGER (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 4, pp. 1-124).—This is a review of experience at the station, the results of which are thought to "furnish conclusive evidence and emphasize the fact that the larger part of light and moderate applications of ground limestone, when applied to a soil in need of lime and similar to the silt loam at the station, decomposes within a year. Even at the end of five years, however, traces remain; this may be due to the superior resistance of the larger particles retained in the ground limestone. Other experiments have shown that limestone screenings ($\frac{1}{4}$ to $\frac{1}{2}$ in.) are very slowly decomposed, indicating that they have but slight value unless applied in excessive amounts.

"The data indicate that although there is a considerable loss of bases when limestone is applied to the soil at any rate, such loss is excessively large when the rate of application greatly exceeds the amount which can be absorbed by the soil.

"Small or moderate applications frequently repeated would probably pay better in the final analysis than large applications at less frequent intervals."

The fertilizing value of wastes from the hemp industry. A. DRAGHETTI (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 5-6, pp. 324-333).—This is a brief description of the hemp treating process and a review of different analyses of the waste liquors and materials from the process.

(Fertilizers, season 1915-16). B. B. ROSS (*Ala. Dept. Agr. Bul.*, 7 (1916), No. 75, pp. 96).—This bulletin reports the results of actual and guaranteed analyses of 466 samples of fertilizers and fertilizing materials offered for sale

Alabama during the fiscal year ended September 30, 1916, together with general information on the classification of fertilizer materials and formulas for home mixtures, the text of the Alabama fertilizer law, and a list of concerns licensed to sell fertilizers in the States during the year.

Analyses of commercial fertilizers, ground bone, and agricultural lime. S. CATHCART ET AL. (*New Jersey Stas. Bul.* 303 (1916), pp. 5-52).—Supplementing previous work (E. S. R., 36, p. 429), this bulletin contains the results of actual and guaranteed analyses of 283 samples of fertilizers and fertilizing materials, 43 samples of ground bone, and 35 samples of agricultural lime

collected for inspection in New Jersey during 1916, together with a list of brands registered for sale.

Analyses of fertilizers and cottonseed meal, R. W. KILGORE ET AL. (*Bul. N. C. Dept. Agr.*, 37 (1916), No. 10, pp. 86).—This report contains the results of actual and guaranteed analyses of 1,371 samples of fertilizers and fertilizing materials and 187 samples of cottonseed meal collected for inspection in North Carolina during the fall of 1915 and the spring of 1916.

List of fertilizer and lime manufacturers and importers (*Penn. Dept. Agr. Bul.* 289 (1917), pp. 47).—This bulletin gives the texts of the Pennsylvania fertilizer, bone, and lime laws, and a list of fertilizer manufacturers and brands of fertilizers licensed for sale during 1917.

AGRICULTURAL BOTANY.

Plant physiology as horticultural theory, H. MOLISCH (*Pflanzenphysiologie als Theorie der Gärtnerei*. Jena: Gustav Fischer, 1916, pp. X+305, figs. 128).—The seven sections of this book, which is intended primarily for horticulturists, deal principally with plant nutrition, respiration, growth, freezing and frost killing, reproduction, germination of seeds, and variability, inheritance, and plant breeding.

Applied and economic botany, H. KRAEMER (*Philadelphia: Author*, 1916, 2. ed., pp. VIII+822, pls. 2, figs. 420).—In the present edition (E. S. R., 33, p. 27), the text has been revised, bringing the work up to date. Among the portions added are a glossary and a concise statement regarding the nature and properties of vitamins.

Canalgre, a quick-growing tannin plant for acclimatization in France, A. PÉDALLU (*Compt. Rend. Acad. Sci. [Paris]*, 163 (1916), No. 20, pp. 575, 576).—This is a discussion of canalgre (*Rumex hymenosepalus*) as a rapidly growing and abundant source of tannin to take the place of the oak and chestnut trees destroyed by military activities in portions of France.

New names in Amygdalus, P. L. RICKER (*Proc. Biol. Soc. Wash.*, 30 (1917), pp. 17, 18).—It has been considered necessary, in accordance with present usage, to make several transfers from *Prunus* to *Amygdalus*. A list is given of such recent transfers, resulting in 14 species of *Amygdalus*.

Studies in the nomenclature and classification of bacteria. The problem of bacterial nomenclature, R. E. BUCHANAN (*Jour. Bact.*, 1 (1916), No. 6, pp. 591-596).—The author expresses the view that the present time is propitious for the careful formulation of general rules of bacteriological nomenclature and of a general scheme of bacterial classification. Regarding this work several suggestions are offered.

Preliminary note on the classification of some lactose-fermenting bacteria, M. LEVINE (*Jour. Bact.*, 1 (1916), No. 6, pp. 619-621).—A key is given which is said to be the result of a study of 333 lactose-fermenting organisms isolated from soil, sewage, and animal sources. The subdivisions proposed are not based upon single characters but upon differences in groups of characters. The names employed are considered as tentative only.

The preparation of culture media from whole blood, R. A. KESLER (*Jour. Bact.*, 1 (1916), No. 6, pp. 615-617).—Describing the method employed in the preparation of a whole blood culture medium, said to be more easily and quickly prepared than ordinary beef infusion and to be inexpensive and well adapted to organisms which do not thrive well on ordinary culture media, the author states that this can practically replace the more difficult preparation serum agar. A concentrated extract from blood, which was still further reduced by evaporation, proved satisfactory as a culture medium.

The development of *Azotobacter*, A. CAUDA (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 2, pp. 125-131).—Details are given of a study during several years of *Azotobacter*, as regards its morphology, its relationships, and its physiology as 'influenced by salts of phosphoric acid, by calcium carbonate, by magnesium and nitrogen compounds, by humus and various other soils, and by association with other organisms.

The soils which are rich, well worked, and provided with humus and mineral fertilizers, prove to be those in which the development of *Azotobacter* is most active. This fact agrees with the observed results obtained from practice on well-managed farms.

The oxygen requirements of biological soil processes, T. J. MURRAY (*Jour. Bact.*, 1 (1916), No. 6, pp. 597-614).—In the work here detailed, which was planned to test the relative influence of aerobic and anaerobic conditions on some fundamental processes due to the agency of soil bacteria, the author found that denitrification goes on under aerobic and anaerobic conditions, being little affected by either. Denitrification proceeds better in solutions than in soils, nitrogen being lost in the greenhouse type of soil used but not in either a silt loam or a clay hillside soil.

Depression of the freezing point in triturated plant tissues and the magnitude of this depression as related to soil moisture, R. P. HERBARD and O. E. HARRINGTON (*Physiol. Researches*, 1 (1916), No. 10, pp. 441-458).—This paper deals with the freezing-point lowering that characterizes the pulpy mass formed by grinding plant tissues, and presents evidence that this lowering is as valuable a criterion for comparing osmotic concentrations of the tissues as is the corresponding index for the expressed juice. The material was first subjected to a preliminary freezing, to render the cell membranes more readily permeable to dissolved materials, after which it was thoroughly triturated. The pulp thus prepared was placed in the cryoscopic apparatus and its freezing-point depression determined just as is usually done with the sap expressed from such pulps. Beckmann's freezing point apparatus was employed.

It was found that this method of testing the pulp without pressing gave concordant results when different samples of the same pulp were tested. In a series of duplicate tests the greatest plus or minus variation between two lowerings that one might expect to be alike was only 0.5 per cent; usually it was less than this. Comparisons of the depressions obtained from tests of plant pulps with those from tests of the expressed juices of the same pulps showed that the two values obtained in these two ways were practically identical, providing that the process of pressing had been very thorough. The agreement was usually within much less than 1 per cent.

The materials employed in these tests were potato tubers, cabbage leaves (from the head), apples, lemons, oranges, grapefruit, onion bulbs, and the tops and roots of maize plants grown in pot cultures. In the case of the maize plants the pots were furnished with autoirrigators, so arranged that six different degrees of soil moisture were practically maintained, in as many different cultures. It was found that the triturated tops showed depressions of from 1.835° C. (culture with mean soil moisture of 31 per cent on dry weight) to 2.204° (culture with soil moisture of 11 per cent), and that the ground roots showed corresponding depressions of from 0.492 to 0.995°. The root material thus had a much lower depression (and consequently a much lower osmotic concentration) than the top material. The depression of the freezing point was found to increase, for both tops and roots, as the moisture content of the soil in which the plants grew decreased, from culture to culture in the series. The order of magnitudes was the same for both roots and tops, being the reverse of the order for soil moisture content.

A list of 27 references to literature bearing on the subject is appended together with an author index.

Glandular hairs on roots, G. HABERLANDT (*Sitzber. K. Preuss. Akad. Wiss., 1915, XII, pp. 222-226, figs. 6*).—The author gives a preliminary report of the occurrence, structure, etc., of multicellular glandular hairs. These were discovered to exist in greater or less abundance on nearly all the rootlets from 2 to 8 mm. in length, springing, with adventitious buds, from marginal leaf notches of *Bryophyllum calycinum* kept in a glass in the laboratory. The various forms are described and discussed.

Absorption of nutrients as affected by the number of roots supplied with the nutrient, P. L. GILZ and J. O. CARRERO (*U. S. Dept. Agr., Jour. Agr. Research, 9 (1917), No. 3, pp. 73-95, figs. 2*).—In a contribution from the Porto Rico Experiment Station, the authors give a report on tests conducted in water cultures to see whether a plant could absorb a maximum amount of one mineral element which was supplied to only part of the roots if all other essential elements were supplied to all the roots. The plants were grown with their roots divided between two flasks, one of which contained a complete nutrient solution and the other a nutrient solution lacking one element, and the absorption of nitrogen with rice and corn and of phosphorus, potassium, and iron with rice was tested.

The results show that, under the conditions of the experiments, the plant is not able to absorb a maximum amount of the element, and the fewer the number of roots supplied with the element, the smaller the amount absorbed. This is found to apply when the total amount of the element supplied is equal to or in excess of the needs of the plant. With nitrogen and phosphorus, the total amount of the element absorbed by plants with half their roots in the complete solution was equal to 0.76 of that absorbed by plants with all their roots in a complete solution. The similar figure for potassium and iron was 0.66. An increase in concentration of the element in question in the complete solution did not appreciably alter the results. The amount of the element absorbed per gram of roots increased greatly as the number of roots in the complete solution was diminished.

Attention is called to the bearing of these results on the method of applying fertilizers.

The excretion of acids by roots, A. R. HAAS (*Proc. Nat. Acad. Sci., 2 (1916), No. 10, pp. 561-566*).—Controlled experiments with sweet corn seedlings grown in water culture indicated that no acids other than carbon dioxide were excreted by the roots. The increase in the alkalinity shown by one culture in quartz in seven days is thought to indicate the presence of some dead cells not visible. Distilled water into which only the roots of wheat seedlings extended showed a very slight increase in alkalinity when the roots had decayed, but when the screen, seeds, and roots were in water a slightly greater increase in alkalinity was noticed.

Leaf epidermis and light perception, G. HABERLANDT (*Sitzber. K. Preuss. Akad. Wiss., 1916, XXXII, pp. 672-687*).—This is mainly a discussion of contributions by other investigators as bearing upon the author's theory regarding the sensitivity to light of foliar organs. According to this view, structural peculiarities in the cells near the upper side of the leaf cause differences in illumination, and thus serve as a means of detecting the direction of the incidental light ray.

The chemical organization of the assimilatory apparatus, R. WILLSTÄTTER and A. STOLL (*Sitzber. K. Preuss. Akad. Wiss., 1915, XX, pp. 322-346, fig. 1*).—Several series of tests with flowers having foliage of different colors are de-

tailed. The fact that assimilation supposedly requires the presence of both chlorophyll and an enzyme is considered to indicate that these factors work together in that process. Chlorophyll supposedly forms a dissociable compound with carbon dioxide. The absorption capacity of green, dry, and powdered leaves for carbon dioxide was studied under different conditions and the results are described. It is considered possible that carbamino compounds may be formed from amino or albuminous compounds. The absorbing substance is supposed to act as an accumulator effecting, or favoring, condensation of carbon dioxide.

Assimilation of organic nitrogen by *Zea mays* and the influence of *Bacillus subtilis* on such assimilation. R. O. BRIGHAM (*Soil Sci.*, 3 (1917), No. 2, pp. 155-195, pls. 2, figs. 2).—This work was carried out in order to ascertain whether higher plants can utilize organic nitrogen directly without the agency of micro-organisms, to determine the relative importance of the compounds used, and to show how the utilization of organic compounds by plants is affected by the action of a bacterium known to be able to decompose such compounds with the production of ammonia. The work includes experiments on the influence of different nitrogenous compounds, in sterile or inoculated cultures, upon the growth of seedlings of two varieties of Indian corn.

It is stated that *Z. mays* uses asparagin, casein, cottonseed meal, hemoglobin, linseed meal, uric acid, peptone, guanin, alanin, urea, creatin, malt, and glyocoll, these organic nitrogenous substances being named in order of their availability. Guanidin carbonate, guanidin nitrate, diphenylamin, caffein, and benzamid are unfavorable to the growth of *Z. mays*. Guanin is toxic to popcorn but not to dent corn.

Organic substances found to be directly available, but to produce better growth when acted upon by *B. subtilis* were peptone, guanin, alanin, linseed meal, cottonseed meal, casein, hemoglobin, and urea, the last showing this effect only with popcorn. The action of *B. subtilis* did not increase the availability of urea (by dent corn), sodium nitrate, asparagin, ammonium sulphate, uric acid, malt, creatin, glyocoll, and those compounds which were toxic.

Substances found to be better than sodium nitrate in case of dent corn were cottonseed meal, linseed meal, casein, hemoglobin, uric acid, and asparagin. Urea, peptone, guanin, alanin, and creatin, though available, were not better than sodium nitrate. Guanin was toxic to popcorn but available to dent corn. The compounds of the benzene ring were found to be exceedingly toxic to the plants tested.

Ammonium sulphate is said to be a far better source of nitrogen for dent corn than is sodium nitrate, being surpassed only by casein and asparagin. Generally speaking, organic compounds of high complexity are better after ammonification, those of low complexity not being improved thereby. It is thought that nitrification following ammonification would be detrimental. The simpler method of measuring growth by length of leaves gave results very nearly parallel to those obtained by determining the dry weight.

The catalytic action of potassium nitrate in the alcoholic fermentation produced by *Sterigmatocystis nigra*, M. MOLLARD (*Compt. Rend. Acad. Sci. [Paris]*, 163 (1916), No. 20, pp. 570-572).—Alcoholic fermentation ascribed to *S. nigra* in a nutritive solution, following a 0.2 per cent addition of potassium nitrate, was 3.3 times as active as that produced by the addition of the same quantity of ammonium chlorid. The optimum for the former solution was reached at a concentration of 0.4 per cent, as contrasted with a concentration of approximately 5 per cent required for the optimum fermentation with yeast which has been reported by some other investigators.

Stimulation and injury to plants by acids, I. ONODERA (*Ber. Ohara Inst. Landw. Forsch.*, 1 (1916), No. 1, pp. 53-110, pls. 2).—Having made a study of the effects of acids on the germination and growth of several cereals and legumes, the results of which are tabulated, the author states that lactic acid is almost harmless to growth. Formic acid stimulates germination in barley, but hinders growth in rice and clover. The effects of hydrochloric acid were decided, but it was surpassed, as regards root injury, by butyric acid. Nitric acid was generally less injurious than the other acids tested, favoring considerably, in dilute concentrations, both germination and growth in rice. Hydrochloric and sulphuric acids strongly stimulated germination and growth, but tended to kill the seedlings eventually.

Acids in moderate concentrations generally tend to produce stimulation, also hastening the attainment of maturity in the plant. Longitudinal growth is more particularly encouraged by acids than is growth in thickness. The increase of growth of plants in dilute acids generally continues longer in the leaves than in the roots.

The various acids are classified according to their injurious effects on plants.

Frost and alterations in leaves of trees, G. ARNAUD (*Bul. Soc. Path. Veg. France*, 1 (1914), No. 1, pp. 21-25, figs. 2).—A study was made of a leaf injury of chestnuts in Paris, which had been ascribed to the influence of tar. The author considers it due to cold weather in spring, in some cases accompanying or conditioning attacks of certain fungi on the leaves.

Effect of environmental conditions upon the number of leaves and the character of the inflorescence of tobacco plants, H. A. ALLARD (*Amer. Jour. Bot.*, 3 (1916), No. 9, pp. 493-501, pls. 4).—In a study of very severely stunted tobacco plants it was found that the average number of nodes produced above the cotyledons, exclusive of the branches of the terminal whorl, remained constant under all conditions, but that the size of the inflorescence was reduced by unfavorable conditions. Extreme stunting may result in suppression of the branches of the terminal whorl, the inflorescence being reduced to the terminal bloom.

The shedding of flower buds in cotton, S. C. HARLAND (*West Indian Bul.*, 16 (1916), No. 1, pp. 72-78).—The author has studied the shedding of buds by cotton to test the truth of the statement that if West Indian native cottons be sown out of season they will refuse to bloom until the proper flowering time, November to May.

It is stated that West Indian native and Seredo cottons from Brazil exhibited periodicity, normally producing no flowers during a period extending roughly from June to September. Such types as upland and Sea Island showed no such periodicity.

Shedding was not greatly influenced by root conditions or rainfall. It was shown by the F_1 generation of a cross between Sea Island and West Indian native cotton, the presence of the habit being thus dominant to its absence in this cross. The F_1 progeny of upland and West Indian native cotton did not shed their buds, the absence of the habit being dominant in this case.

A correlation is suggested between resistance to cotton leaf blister-mite (*Eriophyes gossypii*) and periodicity in flowering.

On the genetics of crinkled dwarf rogues in Sea Island cotton, I, S. C. HARLAND (*West Indian Bul.*, 16 (1916), No. 1, pp. 82-84, fig. 1).—The author noticed in 1915 in a plat of Sea Island cotton made up of the progeny of single plant selections since 1910, certain rogue plants showing reduction in size of all the vegetative parts and in the seed weight, also crinkling, mosaic, and raggedness of edges in the leaves, extreme development of the sympodial habit,

and a tendency to excessive boll shedding amounting to complete sterility in some plants. He has succeeded in growing a few plants from self-fertilized seeds, all of which proved to be rogues, while in case of seeds not self-fertilized the majority of the plants were rogues.

A large number of crosses were made between rogues and Sea Island cotton, the characters of the latter being completely dominant to those of the former. Later, one of the rogues threw off some of the rogue characters. It is thought that the rogue may be considered as a retrogressive mutation due to the loss of a single factor, the deficiency in the proportion of rogues being explained as due to their weakness and liability to early attack by angular leaf spot disease and by mole crickets. Further work in this connection is considered necessary. On the partial sterility of *Nicotiana* hybrids made with *N. sylvestris* as parent, II, T. H. GOODSPEED and A. H. AYRES (*Univ. Cal. Pubs. Bot.*, 5 (1916), p. 9, pp. 273-292, pl. 1).—Having continued the investigations previously noted (E. S. R. 29, p. 320), the authors state that the F_1 hybrids between *N. tabacum* varieties and *N. sylvestris* produce very little pollen of normal appearance, while the anther cells show, almost exclusively, shriveled, functionless grains. The apparently normal F_1 pollen did not germinate in its own stigmatic secretion, in that of the parents, or in any one of a great variety of artificial germinating fluids. The pollen of the parents germinated readily in the stigmatic secretion of the F_1 flowers.

The evidence is considered to oppose the view that specific chemical substances play an important rôle in determining whether or not pollen will germinate, and certain results of tests made on germination and growth reaction are deemed to be the effect of the reagents upon the swelling of cell colloids. The abscission-layer formation is the cause of the fall of flower and fruit, and the stimulus thereto is nonfertilization. Fall of flowers and fruits can be retarded by lowering the total concentration of available mineral materials or nutrients, variations in individual constituents being ineffective.

A few normally matured ovules capable of fertilization are produced in the flowers, and a little viable seed is formed after pollination with the normal pollen of the parents. Back crosses are difficult to make in the field, but plants under conditions of low nutrition retained their flowers longer and back crosses were usually successful, though no increase of fertilizable ovules resulted from the more favorable condition for successful back crossing. Grafts between the hybrid and its parent *N. tabacum macrophylla* resulted in pollen similar to that from the same plants grown on their own roots, but the flowers and fruits were better retained in the former case.

On the partial sterility of *Nicotiana* hybrids made with *N. sylvestris* as parent, III, T. H. GOODSPEED and J. N. KENDALL (*Univ. Cal. Pubs. Bot.*, 5 (1916), No. 10, pp. 293-299).—Continuing the work noted above, the present paper gives the results of experiments to ascertain the mode of abscission of flowers and fruits on the F_1 species of *Nicotiana* hybrids. These studies are considered to yield further evidence regarding the relation between successful pollination and fertilization on the one hand, and abscission of flowers and fruits on the other. The general problem and the literature of abscission are to be dealt with later in a more extended discussion.

It is stated that in *N. tabacum*, *N. sylvestris*, and other hybrids, also in *N. langsdorffii*, the abscission zone is to be found at the base of the pedicel. A conspicuous grooved ridge, or ring, of tissue stands out around the base of the pedicel in *Nicotiana* species, which may indicate the position of motor tissue of a node. The position of the abscission-layer is independent of this groove, being usually distant from it 5 to 7 cell layers. Abscission appears to take place in any portion of the abscission zone distal to the groove, starting in the

cortical tissues just beneath the epidermis on the ventral side and extending around the cortex. There is neither indication of cell division in the tissue involved nor evidence of alteration of cell walls by dissolution of the middle lamellæ or elongation and softening of the entire wall. The separation of the cells appears to be due mainly to increased turgor. Contact may persist until some mechanical agency, as a slight shaking or tapping, breaks the epidermis and the few tracheal elements which may remain intact. The number of cells actually concerned in the process of abscission is greater in the hybrids mentioned than in the parental species, and the same is true of automatic as contrasted with spontaneous abscission.

FIELD CROPS.

[Report of field crops work at the Minnesota Station] (*Minnesota Sta. Rpt. 1916*, pp. 38-42).—Additional data on the cost of tobacco growing are reported. The estimated cost per acre was \$36.53, as compared with \$24.25 previously reported, due chiefly to adverse weather conditions necessitating extra hand labor. The yield averaged 1,250.51 lbs. per acre, selling at an average price of 7.5 cts. per pound, and graded as filler.

Selection tests are reported with winter and spring wheat and with oats, as well as cultural studies with alfalfa, Sudan grass, and sweet clover.

The results of crop rotation experiments show increased yields of 13.7 per cent for corn, 14.95 per cent for oats, and 30.98 per cent for wheat, secured in a 4-year rotation of oats, wheat, clover, and corn, as compared with continuous cropping. In the same rotation increases in net gains per acre, as compared with continuous cropping, were for corn 21.4 per cent and for wheat 72.3 per cent.

Corn yields on land plowed in the fall and early spring were practically equal. The growing of oats and the securing of a stand of clover and timothy on spring-plowed land was not so satisfactory as on fall-plowed land or on double-disked corn land.

[Report of field crops work at the Crookston substation] (*Minnesota Sta. Rpt. Crookston Substa., 1910-1916*, pp. 27-70, 81, 82).—Cultural, variety, fertilizer, and rotation tests are reported, together with brief notes on corn-breeding work and methods of weed eradication.

Rate-of-seeding tests have been conducted with corn, oats, barley, spring and winter wheat, and winter rye. The winter cereals have not proved satisfactory, owing to excessive winterkilling, while tests with spring-sown grain have failed to give conclusive results and will be continued.

Tests of different methods for protecting winter wheat were begun in 1911 but failed to give very satisfactory results until 1916. Wheat sown on corn left uncut yielded 43.5 bu. in 1912 and 32.1 bu. in 1916. Wheat sown on corn stubble and covered with 1 ton of straw per acre yielded 28.8 bu. in 1916. The tests with straw covering are to be continued.

Trials of seeding alfalfa and red and sweet clover with wheat and oats at different rates as nurse crops, and with no nurse crop, were begun in 1915. With a nurse crop, in 1915, a stand of 60 per cent and low vigor resulted without any apparent difference between the rates of seeding, while without a nurse crop, a 100 per cent stand and excellent vigor were secured. The 1916 results were rather contradictory, due to the relatively short and less rank growth of the nurse crops. Field tests with alfalfa to determine the relative importance of various factors in their influence upon the growth of the crop indicated that they rank as follows: No nurse crop, manure, inoculation, and lime.

Other cultural projects which are briefly noted include tests of subsoiling, deep plowing, and packing the seed bed, a comparison of tractor and horse plowing and disking, date of plowing, and disking stubble tests. Final conclusions are not yet drawn.

In variety tests with oats, 1911-1916, the seven highest-yielding varieties, Danish Trifolium, King Oscar, Improved American, Canadian 429, Golden Beauty, Swedish Victory, and Early Everett averaged over 55 bu. per acre. Early Champion, Kischeuer, Big Four, New Zealand, and Swedish Select, the five lowest-yielding varieties, averaged under 45 bu. per acre.

Swanbals barley, with an average yield of 40.1 bu., was first of the two-rowed types, with Gutecon lowest with a yield of 24.6 bu. The highest-yielding six-rowed type was a Russian variety, which yielded 44 bu. per acre, with the lowest yield from Eagle No. 913, 21.82 bu.

With wheat, the three highest-yielding varieties, Minnesota No. 951, Marquis, and Kubanka, averaged over 24 bu. per acre. The four lowest-yielding varieties, Minnesota No. 160, Rysting, Powers, and Eames, averaged from 15 to 18 bu.

Field tests with millet, field peas, soy beans, clover, and alfalfa have continued for a period of 20 years to determine the adaptability of these crops to northwestern Minnesota. Variety tests were begun in 1913. The highest yield of forage was secured from Early Amber cane, 10,757 lbs. per acre, in 1916, with Sudan grass second with a yield of 7,454 lbs. Southern German millet gave a four-year average yield of 7,394.25 lbs. Blue Scotch No. 1436 field pea gave the highest average yield, 13 bu., of the varieties tested.

In 1915, 12 varieties of grasses, 4 of legumes, and 7 combinations of grasses and legumes were seeded separately and harvested for the first time in 1916. Of the grasses sown alone, the highest yield was secured from meadow fescue, 6,780 lbs. per acre. Sweet clover, with a yield of 6,330 lbs., was highest for the legumes. The highest yielding combination consisted of 10 lbs. *Bromus inermis*, 6 lbs. tall meadow oat grass, 2 lbs. white clover, and 4 lbs. alfalfa, and gave a yield of 6,660 lbs. per acre.

In corn variety tests, Northwestern Dent gave the highest grain yields for the two years reported, 1914 and 1916, with 46.87 and 38.4 bu., respectively.

Tests with flax for fiber, conducted in cooperation with the Office of Fiber Investigations, U. S. Department of Agriculture, in an effort to develop strains of fiber flax adapted to northwestern Minnesota, are reported. Hemp has been successfully grown for fiber at the station.

The following are the highest average yields per acre secured in crop-rotation tests from 1911 to 1916, inclusive: Wheat, 22.84 bu. in the three-year rotation, with a yield of 16.25 bu. for continuous wheat; oats, 57.7 bu. for the seven-year rotation, with a yield of 53.8 bu. for oats grown continuously (two-year average); barley, 43.3 bu. for continuous barley (two-year average) and 39.03 bu. for the seven-year rotation; flax, 15.73 bu. in the seven-year rotation; corn, 39.83 bu. in the seven-year rotation, with a yield of 34.33 bu. when grown continuously; potatoes, 98.2 bu. in the four-year rotation (two-year average) without manure, fertilizer, or legume; and hay, first year, 4,765 lbs. in the seven-year rotation, and second year, 1,918 lbs. in the five-year rotation.

Data are presented showing the results of commercial fertilizer tests with and without manure for crops grown in rotation for 1914, 1915, and 1916. No definite conclusions have been drawn.

Eradication of quack grass has been accomplished through severe bare fallow, followed by corn.

A number of potato variety tests are reported. Early Ohio is deemed the best market variety for this region, while Irish Cobbler is a high yielder and

the best early white potato tested. Carmen No. 1, Green Mountain, and Carmen No. 3 are considered the best late varieties. In cultural tests to determine the size of seed pieces, the double eye and quarter sizes have given the highest yields per pound of seed. A planting rate of 16 bu. per acre gave an average yield of 140.25 bu. as compared with a yield of 78.26 bu. from a 10-bu. planting rate. Hill-selected seed gave an average yield of 184.92 bu. per acre, as compared with a yield of 134 bu. from cellar-selected seed, 64.75 bu. from field run, 68.72 bu. from run-out seed, 138.15 bu. from tuber-unit selection, 73.4 from little field-run stock, and 144.6 bu. from little-selected stock. Tests with various treatments for seed potatoes and spraying tests for tuber and leaf diseases and insect pests are also reported.

Twenty-four varieties of rutabagas, mangels, carrots, and stock turnips have been tested. The highest-yielding varieties were the White Half Sugar mangels, 24.86 tons; Sweet Russian rutabagas, 488.8 bu.; Cowhorn turnip, 504 bu.; and Mastodon carrots, 355 bu. per acre.

[Report of field crops work at the Crookston substation] (*Minnesota Sta. Rpt. 1916*, pp. 68-70, 72).—Field crops work for 1915, as noted above, is briefly reviewed.

[Report of field crops work at the Duluth substation] (*Minnesota Sta., Rpt. Duluth Substa., 1916*, pp. 5, 6, 7, 9; *abs. in Minnesota Sta. Rpt. 1916*, pp. 79, 80).—In variety tests the average oat yield for the season was 42.5 bu. per acre and the time required for maturity from 93 days for Sixty Day oats to 113 days for the White Russian side oats. The early-maturing strains are considered the best yielders. The average barley yield was 20 bu. per acre, with Minnesota No. 105, a 6-rowed variety, highest. The 2-rowed barley, Princess, required 93 days to ripen, while all others required 87 days. The Alaska variety of peas is recommended because of its early maturity (84 days). Minnesota No. 95 required 112 days. Twenty-two varieties of corn were tested, the following giving the most promise for fodder: Minnesota No. 13, Northwestern Dent, Longfellow, and King Philip Flint.

Flax sown June 1 matured in 101 days. Rutabagas planted in May were harvested the middle of October, little difference being noted between three standard varieties.

Fertilizer tests under a 3-year rotation plan, using rock phosphate manure and acid phosphate, are reported. The crops grown were potatoes and rutabagas.

Three methods of seeding grass on cut-over land were compared. Harrowing with a spring-toothed harrow before and after seeding proved more satisfactory than harrowing before seeding, and this in turn was superior to harrowing after seeding.

[Report of field crops work at the Grand Rapids substation] (*Minnesota Sta. Rpt. 1916*, pp. 75, 76, 77).—The crop yields secured in 1915 and the projects in progress are briefly noted.

The average yield for all oats was 76.9 bu. and the average of 13 varieties, 91.7 bu., with Sixty Day highest with 110.6 bu. The wheat average was 28.9 bu. per acre. The average of 13 varieties was 28.6 bu., with Prelude highest with 30.6 bu., followed by Marquis with 30.5 bu., and Haynes Bluestem with 30.3 bu.

The average barley yield was 42.6 bu. per acre, with an average for 10 varieties of 34.6 bu. O. A. C. No. 21 gave the highest yield, 63.9 bu. for the 6-rowed varieties, and Champion of Vermont, 55.6 bu. for the 2-rowed varieties.

Average yields were secured of corn for silage 3.4 tons; potatoes, 136.6 bu.; clover and timothy (first cutting), 2.42 tons; and rutabagas (topped), 24.47 tons per acre. Potato trials indicated homegrown seed to be superior to im-

ported seed. Meadow fescue showed promise as a grass crop for either hay or pasture on muskeg.

[Report of field crops work at the Morris substation] (*Minnesota Sta., Rpt. Morris Substa., 1915, pp. 5-12, figs. 3; abs. in Minnesota Sta. Rpt. 1916, pp. 73, 74*).—Field experiments at the West Central substation at Morris for 1915 were confined to crop rotations, fertilizer tests, and variety and seedling trials with the farm crops common to western Minnesota.

A four-year rotation of corn, wheat, oats, and clover is being grown with 18 plats in each crop each year. These plats receive six different treatments, including no fertilizer, rock phosphate alone, acid phosphate alone, manure alone, rock phosphate with manure, and acid phosphate with manure. Two seasons' crops have been harvested and the results tabulated, but thus far have not shown sufficiently increased yields over the untreated plats to pay the cost of applying the fertilizer.

Yields of 21 strains and varieties of alfalfa being tested in nursery rows are reported. The Grimm, Baltic, and Imported Turkestan varieties appear to be sufficiently hardy to withstand the winters of this locality.

Alsike clover has proved satisfactory on wet lands.

Yields of 9 varieties of corn tested which failed to mature fully, 7 varieties of spring wheat tested for rust resistance, and 3 varieties of barley damaged by storms, are reported.

Of 7 varieties of oats tested the yields varied from 64.2 to 100.5 bu. per acre. Improved Ligowa gave the highest yield with the least lodging. Marrowfat peas yielded 24.3 bu. per acre, as compared with 9.5 bu. from Early Alaska.

[The Woburn field experiments, 1915], J. A. VOELCKER (*Woburn Exptl. Sta. Rpt., 1915, pp. 1-15, 20-29; Jour. Roy. Agr. Soc. England, 76 (1915), pp. 317-330, 334-344*).—In continuation of work previously reported (*E. S. R., 35, p. 30*), this deals with the season of 1915, which was marked by heavy rainfall during the winter and a prolonged drought in the summer.

In the wheat experiments the plat receiving farmyard manure gave the highest yield, 24.4 bu. per acre, together with the most straw. The plat receiving rape dust gave the second highest yield, 23.2 bu., while the average of the two unfertilized plats was 12.9 bu. With mineral manures alone the yield was about 1 bu. less per acre than on the unmanured plats, but there was rather more straw. Ammonium sulphate used alone was unsuccessful, but upon the addition of lime increased yields were obtained. Nitrate of soda showed, on the whole, better results than sulphate of ammonia, probably due to the dry season. The use of phosphates produced 1 bu. more per acre than the use of potassium sulphate. The highest quality of wheat was obtained from the nitrate of soda plats, that from the farmyard manure plat being graded as only moderate.

In order to determine whether flax is a soil-exhausting crop wheat was sown on two adjoining fields, from one of which flax and the other oats had just been removed. The yield after flax was just double that after oats.

In the barley experiments, determinations showed a higher moisture content on the nitrate of soda plats than on the ammonium sulphate plats. The highest barley yield, 27.3 bu., was obtained from the plat receiving farmyard manure, while the plat receiving mineral manures and 1 ton of lime in 1915 was second, with 19.1 bu. The average for the untreated plats was 10.2 bu. The use of ammonium sulphate alone gave no crop, and when used with lime inferior yields were obtained, but when mineral manures were added an increased yield resulted. Sodium nitrate alone gave poor results, although increased yields were obtained when used in conjunction with mineral manures.

The yield was smaller by 2.2 bu. per acre after the use of potash than with phosphates, and the quality of the barley was reported as poor. Variety tests with barley were continued, Chevallier yielding 13 bu. more than Tystofte and 19 bu. more than Svalöf, but its quality being inferior to that of the other two.

Rotation experiments to study the unexhausted manurial value of grain (barley, oats, and chaff) and cake (linseed cake, cottonseed cake, and chaff), when fed to sheep as a supplement to the roots in the rotation, showed tentatively that the corn-fed plat gave slightly higher yields in the subsequent crops.

Tests were continued with clover and grass mixtures, the best yields of hay being obtained from a mixture including "wild" white clover. Variety tests with alfalfa laid down in 1911 show the best results with Russian (Europe) and with Province second.

Mangels were grown beside sugar-beet plats, and it was observed that the beets required approximately three times the labor that the mangels did in harvesting. It was also ascertained that, due to the large amount of earth retained, the beets lost 32 per cent in washing, while the mangels lost only 9 per cent.

In pasture improvement the farmyard manure plat gave the highest returns, but was inferior in quality, while the plat receiving 10 cwt. of basic slag and 1 cwt. of potassium sulphate gave the best all-round results. In testing the varieties of lime best for grassland, Buxton lime showed the highest yield. Lump lime and ground chalk gave better results than ground lime and ground limestone.

In tests instituted in 1913, plats alternately mown and grazed gave the highest yields of hay and left an aftermath of superior quality.

Cultivation and utilization of sunflower, niger, and safflower seed (*Bul. Imp. Inst. [So. Kensington], 14 (1916), No. 1, pp. 88-101*).—Brief notes are given on the cultivation, harvesting, and utilization of the seed of sunflower (*Helianthus annuus*), niger-seed plant (*Guizotia abyssinica*), and safflower (*Carthamus tinctorius*) in South Africa.

The entire sunflower plant produces silage of fair quality. The stalks alone are often used for fuel and the ash, which is high in potash, as a fertilizer. The seed of all three plants is used for oil extraction, and the seed cake resulting as a concentrate.

Pasture problems.—Indigenous plants in relation to habitat and sown species, R. G. STAPLETON and T. J. JENKIN (*Jour. Agr. Sci. [England], 8 (1916), No. 1, pp. 26-64*).—This paper continues work previously noted (*E. S. R.*, 33, p. 227), and attempts to trace (1) the relationship that exists between the several indigenous plants that contribute to the herbage of definite types of grassland, (2) the progressive changes that occur on fields, down to grass for a varying number of years, belonging to these types, (3) the competitive interaction between sown and indigenous species, and (4) the contrast in effect on the herbage of continual mowing and continual grazing.

The types of grassland investigated are divided into two groups, the natural and the seminatural. By natural types are meant those pastures which historical evidence shows never to have been extensively under the plow or manured and which, if broken or manured at some remote period, have completely reverted to type. By seminatural types are meant those pastures which of certainty have been under the plow and, at all events, manured during the rotation previous to reverting to grass. The seminatural types are further classified as the tended and untended. The tended are those pastures which have been down to grass about 20 to 50 years, receiving periodic if but slight dressings of manure and probably sown in the first instance with rye grasses and clovers only

with loft sweepings. The untended are those which have been plowed and probably manured from 50 to 100 years ago and then, after yielding crops for some seasons, allowed to revert to grass without any sowing (with the possible exception of loft sweepings) and have so remained ever since without any further manuring in most cases.

Plants which colonize natural grasslands are called primary indigenous species, and those which come in without being sown and contribute largely to the herbage on seminatural grasslands are designated as secondary indigenous species. Plants that come in alone but which disappear as the field approaches the seminatural are called tertiary indigenous species, and are to be dealt with in a subsequent paper. Plants which are indigenous in a district but do not contribute to the flora of a well-marked type of grassland are called locally native, and those not indigenous in a district exotic. These classifications and distinctions are deemed applicable to all districts and type of grasslands.

Considerable space is devoted to a discussion of the composition of the herbage on the various pasture lands observed and on the stabilization of grasslands. The behavior of the chief plants found on all the types of grassland studied is also discussed under a separate heading for each individual species. The general conclusions may be summarized as follows:

The number of primary species on most types is not considerable and they are usually late in making their appearance in fields put down to grass after a long period of rotation. Primary species which come in early are frequently weeds of arable land, such as *Poa trivialis*, *Festuca rubra*, and *Agrostis vulgaris*.

As regards the relation of primary and secondary species to their commercial and sown counterparts, commercial seed may not appreciably hasten the appearance or add to the quantity of the desired plant. This is especially true of the well-leaved fescues and even of *Trifolium repens*. Phosphatic manures often prove to be sufficient to hasten the appearance of the indigenous plants.

Commercial seed may produce a great bulk of the required plant and only after several years will the plant attain its normal development, indicating that the final plant is the indigenous counterpart of the sown species. Commercial seedling is economically justified in such cases. Commercial seed may also hasten the appearance of the desired species, but there is a risk of the sown plant interfering with the development of the definitely lasting indigenous species; this is more a matter of local importance. The spontaneous appearance of primary and secondary species on land long under rotation when put down to grass may be due to the following: (a) Many species remain as arable weeds; (b) the seeds of many species may be wind borne; (c) seeds may be introduced as impurities in sown seed; and (d) the seeds of a great many species are evidently capable of lying dormant in the soil for long periods.

In addition to the conclusions given above, certain generalizations are presented regarding experimental work on grassland and the whole problem and economics of putting land down to grass. A bibliography of 20 references is given at the end of the paper.

Observations on alfalfa, E. H. JENKINS (*Connecticut State Sta. Bul.* 192 (1917), pp. 12).—Limited observations of four years of alfalfa growing with the Grimm, Sand Lucerne, Kansas-grown, Provence, Utah-grown, and Turkestan strains are briefly noted. Grimm gave the highest average yield for the 4-year period, 4.39 tons per acre, on limed soil. The lowest average yield, 3.4 tons, was secured from the Turkestan variety. These two varieties suffered least from winterkilling, while the Sand Lucerne and Provence suffered slightly, and the Utah- and Kansas-grown strains the most.

The determined cost of plowing, seed bed preparation, liming, and fertilizing (basic slag, acid phosphate, and muriate of potash) amounted to \$53.91 per

acre. The estimated cost of seeding and inoculating, spreading fertilizer, and cutting, curing, and hauling the crop (4 tons per year for four years, at \$2 per ton) brought the total cost of production for four years to \$95.91 per acre.

Beans in Colorado. A. KEZER (*Colorado Sta. Bul. 226 (1917), pp. 5-20, figs. 6*).—Detailed directions are given for preparing the seed bed, planting, cultivating, harvesting, threshing, and marketing the bean crop in Colorado. It is estimated that the acreage planted to beans increased 81 per cent in 1916 over that planted in 1914 and 1915, and that the total yield increased 41 per cent in the same period.

It is stated that Pinto beans, the chief Colorado market variety, average from 300 to 800 lbs. per acre under dry-farming conditions and may yield 1,800 lbs. Under irrigation this variety will average from 1,200 to 2,000 lbs. and may yield 3,000 lbs. or more. The bean straw will average on dry land from one-half to three-quarters ton per acre.

Systematic rotation of beans is urged as a disease-control measure. Wheat following beans on dry land is reported as yielding as well as after the usual summer fallow in most seasons.

The cost of bean production on dry land has been found to average from \$5 to \$8 per acre and on irrigated land from \$9 to \$15. These estimates are exclusive of machinery costs, interest on land, cost of irrigation, ditch upkeep, and rentals.

Clover and clover hay. A. and GABRIELLE L. C. HOWARD (*Agr. Jour. India, 11 (1916), No. 1, pp. 71-78*).—Notes are given on the value and production of Persian clover or shaftal (*Trifolium resupinatum*) in the Quetta Valley, India. Its adaptability to local conditions and the excellent quality of hay obtained under arid conditions have contributed largely to its successful production.

Corn problems.—Choice of varieties; time, manner, and rate of planting. C. A. GEARHART (*Mo. Bul. Ohio Sta., 2 (1917), No. 4, pp. 104-109, figs. 5*).—Brief recommendations are made regarding the choice of varieties and the time, manner, and rate of planting corn.

In date-of-planting tests at Wooster the periods of May 4 to 10 and May 14 to 17 gave the highest yields, 64.22 and 64.36 bu. per acre, respectively, for an 8-year average, while corn planted April 24 to 29 outyielded that planted May 25 to 28 and June 2 to 6. The last two named planting periods produced 26.15 and 38.36 per cent nubbins, respectively, while the other planting periods were comparatively uniform, giving about 17 per cent nubbins. The early-planted corn was also more mature than that planted later, the moisture content at the time of husking varying from 25.85 per cent for the first planting to 36.4 per cent for the last.

Corn drilled rather than planted in hills, with plants 12 in. apart, gave the highest 3-year average yield of grain, 46.88 bu. per acre, and of stover, 2,827 lbs. It is stated, however, that the methods of cultivation and harvesting will determine to a large extent the method of planting to be employed.

In rate-of-planting tests the yields from the four- and five-plant rates were the highest, 64.34 and 62.6 bu. per acre for an 11-year average, respectively, but with a percentage of nubbins of 30.2 and 41.2, respectively. The three-plant rate was deemed the most satisfactory where corn is to be husked. The yield of the latter was 60.95 bu. of shelled corn per acre, with 21.4 per cent nubbins. Where the crop is to be fed from the shock the thicker rates of planting are preferable.

How much plant food does a corn crop take from an acre? E. H. JENKINS, J. P. STREET, and C. D. HUBBELL (*Connecticut State Sta. Bul. 193 (1917), pp. 11, 12*).—From nine series of tests with husking and silage corn at different experiment stations the average amounts of nitrogen, phosphoric acid, and potash

moved by the crop were 57.5, 42, and 67.1 lbs per acre, respectively. Six tests

Mt. Carmel gave for a 15-ton silage crop an average of 88 lbs. of nitrogen, 37 s. of phosphoric acid, and 100 lbs. of potash. Several crops of husking corn, grown elsewhere in Connecticut and calculated at 75 bu. per acre, gave an average of 92 lbs. of nitrogen, 34 lbs. of phosphoric acid, and 74 lbs. of potash. It is estimated that by careful conservation of the manure returned from culling 30 tons of silage approximately 50 lbs. of nitrogen, from 25 to 30 lbs. phosphoric acid, and from 45 to 50 lbs. of potash may be regained regardless of any fertilizing ingredients in the litter or fermenting organic matter which might serve as a soil amendment or plant-food solvent.

Corn variety tests for 1915, R. Y. WINTERS, G. M. GARREN, and B. WHITE *Bul. N. C. Dept. Agr., 37 (1916), No. 4, pp. 5-21*.—Tests of 24 varieties of corn at six experimental farms in North Carolina are reported and compared with the average results of previous tests.

The 2-eared prolific varieties yielded best, except in the extreme western part of the State, where Boone County White, a 1-eared variety, gave the highest yield in a series of five tests. It is recommended that the best 2-eared varieties be improved by selecting for increased yield of grain per stalk rather than a larger number of ears per stalk. For production of silage the 2-eared and more prolific varieties have given a higher yield of dry matter and more food value per acre than the 1-eared varieties.

Egyptian maize (*Zea mays*), G. C. DUDGEON and B. G. C. BOLLAND (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 2 (1916), pp. 5*).—This is a progress report of variety tests with corn at the Gheezeh Experimental Farm in an effort to isolate and describe the varieties grown. Brief notes are also given on the production of the crop in Egypt.

Fique (*Furcraea gigantea*) (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., No. (1916), pp. 169, 170, pl. 1*).—This is a brief note on fique in Colombia, including an enumeration by M. T. Dawe of the principal uses to which the fiber is put.

The culture and manufacture of flax for fiber and seed with special reference to the industry in Oregon, J. F. THORNE (*Univ. Oreg. Bul., n. ser., 13 (1916), No. 13, pp. 70, figs. 5*).—This is a compilation of data and expert opinions on the establishment of the flax industry in Oregon, made by the School of Commerce of the University of Oregon at the request of the Flax Committee of the Portland Chamber of Commerce. It discusses the climatic conditions and advantages of Oregon for flax production, and, in addition, the demand, freights, markets, prices, profits, and conditions of the flax industry in foreign countries.

Indian hemp fiber (*Crotalaria juncea*), C. D'LIMA (*Agr. Jour. India, 11 (1916), No. 1, pp. 31-41*).—This is a general discussion of the hemp situation in India from a commercial standpoint.

[The composition of mangels], C. T. GIMMINGHAM (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1915, pp. 114-119*).—Analyses of six varieties of mangels grown at each of eight experimental centers are reported.

Great millet (*Sorghum vulgare*) and berseem (*Trifolium alexandrinum*), G. C. BOLLAND (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 8 (1916), pp. 5*).—Progress report of work conducted with millets in 1915 in an effort to isolate and describe the individual varieties grown at the Gheezeh Experimental Farm, tests with four strains of berseem are also reported.

Peanuts.—Tests of varieties and fertilizers, J. F. DUGGAR, E. F. CAUTHEN, T. WILLIAMSON, and O. H. SELLERS (*Alabama Col. Sta. Bul. 193 (1917), pp. 32, pls. 4*).—Variety tests covering a period of five years and fertilizer tests extending over six years in different parts of the State are reported.

The average yield of unshelled peanuts obtained in the variety tests ranged from 871 lbs. for the McGovern variety to 1,244 lbs. for Red Spanish. The average percentage of shelled nuts varied from 39.3 for Jumbo to 75.1 for White Spanish. The heaviest unshelled peanuts were the Tennessee Red (246 pods to the pound) and the lightest White Spanish (461 pods to the pound). Based on the average percentage of sound nuts and the oil content of each variety, the varieties, arranged according to pounds of oil produced per ton, are as follows: White Spanish 702 lbs., Red Spanish 693, Valencia 572, McGovern 548, Tennessee Red 527, North Carolina Runner 524, Virginia Runner 493, and Jumbo 374 lbs.

Brief directions are given for preparing the seed bed, planting, cultivating, and harvesting the crop. The largest yields were obtained from plantings made between May 1 and June 15.

Chemical analysis of peanut straw showed 10.72 per cent water, 10.69 protein, 1.66 fat, 29.5 crude fiber, 41.39 carbohydrates, 6.03 ash, 1.2 potash, and 0.5 per cent phosphoric acid.

From tests made to study the residual effect of peanuts on the succeeding crops, as compared with corn, it was concluded that the peanut crop harvested in the usual way for seed does not improve the soil for succeeding crops. From complete fertilizer tests it was concluded that acid phosphate at the rate of 200 to 300 lbs. per acre produced profitable increases in yields on sandy and other well-adapted soils. Potash, as kainit, at the rate of 100 and 200 lbs. per acre was not always profitable except on a few infertile, sandy soils. Slacked lime at the rate of 600 lbs. per acre gave profitable increases on sandy soil. Cottonseed meal as a nitrogenous fertilizer was not profitable.

The average yield of peanut straw from four experiments varied from 2,316 lbs. for North Carolina Runner to 1,234 lbs. for Virginia Bunch per acre. The average percentage of dry, unhulled peanuts to the weight of the whole plant ranged from 32 for North Carolina Runner to 39 for Red Spanish.

Growing peanuts in Alabama, J. F. DUGGAR, E. F. CAUTHEN, J. T. WILLIAMSON, and O. H. SELLERS (*Alabama Col. Sta. Bul. 124 (1917), pp. 35-48*).—A popular edition of the above.

A note on the inheritance of certain stem characters in sorghum, G. R. HILSON (*Agr. Jour. India, 11 (1916), No. 2, pp. 150-155, pl. 1*).—Observations of some selected strains of sorghum in the Madras Presidency led to the conclusion that all of these strains could be placed in one or the other of two groups, according to the appearance of the midrib of the leaf. One group is composed of all plants in which the midrib appears as an opaque white band running the entire length of the leaf, while the other group includes those plants in which the midrib in the lower leaves is marked by dull white, generally broken bands, never extending across the full width of the midrib and rarely to the end of the leaf, while the upper leaves are entirely devoid of any white marking.

Repeated tests have led to the conclusion that a grayish midrib indicates a stem rich in sugar, while a white midrib shows a pithy, insipid stem. With these characteristics in mind a number of breeding experiments were conducted with the following results: (1) The character of the green stem in sorghum can be readily diagnosed from the appearance of the midrib of the leaf, and (2) in breeding tests the pithy, insipid character of the stem behaves as a simple dominant to the sweet-stalked character.

Tests of soy beans in 1916, E. H. JENKINS, J. P. STREET, and C. D. HUBBELL (*Connecticut State Sta. Bul. 193 (1917), pp. 9-10*).—Continuing work previously noted (*E. S. R., 35, p. 532*), the yield and composition of 17 varieties of soy beans are reported. The range in time of maturity in 1916 was from

5 to 127 days; in yield of green forage from 7,362 to 13,590 lbs. per acre, with an average of 9,539 lbs.; in yield of dry matter from 1,992 to 3,325 lbs., with an average of 2,600 lbs.; and in protein from 3.2 to 6.6 per cent, with an average of 4.6 per cent.

Of 12 varieties of soy beans tested for three years the Wilson has produced the highest amount of dry matter per year, 3,329 lbs., with the Mongol variety next, 2,406 lbs. Both varieties required an average of 122 days to attain maturity.

Exclusive of roots the crops of the last three years contained per acre 3,637 lbs. of organic matter, 111 lbs. of nitrogen, 20 lbs. of phosphoric acid, and 10 lbs. of potash.

The Whippoorwill and Brahman varieties of cowpeas were tested, yielding 542 and 2,160 lbs. of organic matter and 54 and 50 lbs. of nitrogen per acre, respectively. The average composition of the dry matter of soy beans and cowpeas grown at Mt. Carmel during 1916 is compared in tabular form.

Soy bean growing is briefly discussed and the uses of the crop in Connecticut outlined as follows: Sowing as a catch crop following winterkilled grain or clover or a poor spring seedling, from the first of May to the middle of June; as a late summer sowing crop for cattle; as a silage crop grown either with or without corn and cut into the silo—about 3 tons of corn to one of soy beans; as a green manure; and as a seed crop.

Soy beans.—Their culture and use, C. G. WILLIAMS and J. B. PARK (*Ohio Agr. Bul. 312 (1917), pp. 579-600, figs. 4*).—Soy-bean production in Ohio is discussed in detail.

In rate-of-seeding tests 3 pk. of medium-sized soy beans (Medium Green variety), sown in rows 28 in. apart, has usually given the best results for seed production. A seeding of 8 pk. per acre drilled solid gave a smaller yield of seed, but a higher yield of total forage.

Twenty-five varieties and pure-line strains are briefly described, and the results of variety tests in yields of grain and straw and the pounds of straw per bushel of grain are reported in tabular form. The five leading varieties in order of rank were: Ohio 9016, Ohio 7496, Elton (Chestnut), Ito San 17268, and Shinto. The five lowest yielders were Sable, Cloud, Yosho, Mikado, and Saba. The yield in grain per acre for the five-year average, 1911-1916, inclusive, varied from 14.01 bu. for the Sable variety to 29.22 bu. for Ohio 9016. The high-yielding varieties showed a low proportion of straw to grain, ranging from 72 to 97 lbs. of straw per bushel of grain, with an average of 81 lbs., whereas in the five low-yielding varieties the range was from 106 to 164 lbs., with an average of 133 lbs. The total average yield of straw, however, in the two classes varied only 177 lbs. per acre.

Results obtained with a few varieties tested at the experimental farms located in Clermont, Hamilton, Washington, Paulding, and Trumbull counties are also reported.

Tests with ten varieties of soy beans for hay have been conducted at Wooster for five years. The Medium Green variety has given the highest average yield, 5,402 lbs. per acre, with the Mammoth Yellow lowest, with 3,814 lbs. Medium Green is deemed better adapted for hay production than for grain because of its tendency to shatter.

Limited observations have been made of the effect of soy beans upon subsequent crops in the rotation. Fifty rotations are in progress, and 24 wheat crops were harvested in 1916. Ten of these plats followed corn, 6 soy beans, potatoes, and 3 oats. The average yield of wheat following soy beans was 13 bu. greater than that following corn, 1.27 bu. greater than that following oats, and 0.34 bu. greater than that following potatoes.

The uses of soy beans for human and animal food and for such special products as soy-bean meal and soy-bean oil are discussed. Charts are presented showing the relative value of soy beans and several common food materials.

Sudan grass. B. A. MADSON and P. B. KENNEDY (*California Sta. Bul.* 277 (1917), pp. 195-224, figs. 5).—The field practices and cultural methods employed in the production of Sudan grass, both for hay and seed, in California are discussed. Date, rate, and method-of-seeding tests for hay production and method-of-seeding tests for seed production, carried on in cooperation with the U. S. Department of Agriculture, are for 1913, 1914, 1915, and 1916.

The average yield of cured hay varied from 1.8 to 5.9 tons per acre on dry land and 3.9 to 6.7 tons on irrigated land. The average yield of seed is estimated at from 600 to 800 lbs. per acre. For hay production seedlings of from 10 to 15 lbs. in rather narrow rows (18 in.) seemed to give the best results, although heavier seedlings sown broadcast, drilled, or in wider rows gave good results, depending largely upon the available moisture supply. Seeding should not be done until all danger of frost is passed and the soil has become thoroughly warm. From 75 to 80 days after seeding are required to secure the first cutting, about 45 days more for the second, and 50 days more for the third. A seed crop can be produced in from 95 to 100 days.

Analyses are reported of various hay crops for a comparison with Sudan grass and indicate that due to the large production of dry matter (6,367.7 lbs. per acre for a 3-year average) this crop is superior to the usual cereal and grass hays in the amount of food constituents produced per acre, although it can not compete with alfalfa.

It is recommended that Sudan grass be grown in rotation following a spring crop, such as grain or spring pasture, which could be removed by the first to the middle of July.

The method for distinguishing the seed of Johnson grass and Sudan grass devised by Hillman (*E. S. R.*, 35, p. 834), is noted.

Report of the plant breeder. H. B. COWGILL (*Rpt. Bd. Comrs. Agr. P. R.*, 4 (1914-15), pp. 22-33; 5 (1915-16), pp. 16-20, 21-34).—This reports the continuation of work at the Porto Rico Insular Station with sugar cane (*E. S. R.*, 33, p. 532) for the years of 1914-15 and 1915-16.

The propagation of seedling canes and a rigid selection and careful choice of parent varieties has been continued. Several attempts at cross-pollinating cane varieties are reported with a considerable degree of success. The methods employed in 1914-15 included planting a pollen-sterile variety to the leeward of a pollen-fertile variety which blooms at the same time and tying together the tassels of the varieties to be crossed before the florets of either had opened. The pollen-sterile variety used in the first case was the Otahete and the pollen-fertile parent B 347. In the second case Crystalina (the pollen-sterile parent) and D 109 were the varieties used. Sixteen hundred seedlings were produced by the latter method and 1,745 seedlings obtained from open cross-pollination were planted in the field in 1915-1916. Of the last-named group 80 plants were selected as of superior quality. The results of the crosses and the value of different varieties as parents are discussed.

A list of the cane varieties grown most extensively on the island is given and their relative importance discussed. Striped cane, Otahete, and Crystalina take rank in the order named with regard to the area occupied by each. The value of numerous imported varieties, as indicated by actual field observations, is also discussed.

Tests of 25 varieties of cane are reported for 1914-15, showing the yields of plant cane and first and second ratoons, with an analysis of the juice for the

two crops. Seeley Seedling gave the best results, considering the quality of juices and the weight of the cane produced. Twenty varieties of recently introduced cane were tested for the first time during 1914-15, and the test ended in 1915-16. Among these varieties the most promising were B 1800, 345, B 6292, B 3850, B 3405, and B 3747, all giving higher yields than Crysan or Otahelie, the check varieties.

Thirteen leguminous cover crops were tested in 1914-15, and the results are entered in tabular form with regard to germination of the seed, habit of growth, length of growing season, amount of seed produced, and resistance to rot and disease pests.

The average yield of cane from all unfertilized plots in 1914-15 was 8.17 tons per acre as compared with an average yield of 22.46 tons for the plots receiving complete fertilizer. The highest yield, 26.6 tons, was secured from the plot receiving 120 lbs. phosphoric acid, 60 lbs. nitrogen, and 60 lbs. potash. These results are in agreement with those obtained in the two previous years, and in 1915-16 were confirmed in 1915-16, when the highest yield, 20.75 tons, was secured from a double application of a complete fertilizer. All the fertilizer experiments indicated the need of abundant phosphoric acid applications on these soils, while potash and nitrogen fertilization is evidently of secondary importance.

Further fertilizer experiments were conducted in 1915-16 in cooperation with growers on sandy clay and clay soils. The results are reported in tabular form. All combinations of fertilizers gave good returns for the money invested. An application of 4 tons of lime per acre made in 1912 was followed by increased yields of cane of 4.98, 14.75, and 12.1 tons for 1913, 1914, and 1915, respectively.

A comparison of cultivation by hoes and by cultivator was made in 1915-16. Plots receiving four hoeings gave an acre yield of 27.02 tons, at a labor cost of \$1.10, while plots receiving five cultivations gave a yield of 25.03 tons, at a labor cost of \$8.41.

A demonstration of the value of crop rotation in practical cane culture, by L. ROSENFELD (*Sugar [Chicago], 18 (1916), No. 9, pp. 463, 464*).—This is a very full discussion of crop rotation experiments with sugar cane conducted by the author while the director of the experimental work in Tucumán, Argentina. Continuous cropping with sugar cane is compared with cane following one year of peas, corn, and alfalfa, respectively.

Remarkable increases in yield are reported. In a 3-year period, the highest yields were made after alfalfa, although the gains after corn were twice the gains after alfalfa for the Province. The plots planted to cane after alfalfa showed an average annual gain of 3.5 tons per acre, the cane being superior in average weight and slightly richer in juice than that following corn.

New sugar cane experiments in Travancore, N. K. PILLAI (*Agr. Jour. India, 916, No. 1, pp. 79-81*).—In experiments with sugar cane conducted during the 1914-15 season, the ridge and furrow system of planting seemed superior to planting in pits, the common practice in Travancore. Thin planting (5,000 per acre) was better than thick planting (10,000 sets or more). The application of a complete fertilizer was more profitable than that of ashes alone, as is the usual practice.

Washington wheats.—Their classification and identification, E. D. ALFORD (*Am. Agr., 9 (1916), No. 8, pp. 217-219, figs. 2*).—A popular classification of the more common varieties of Washington wheats, based upon (1) head characteristics, and (2) kernel characteristics, each classification being complete in itself.

The wheat field in April.—Top-dressing with fertilizers may often be profitable. C. E. THORNE (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 4, pp. 110-112, fig. 1).—The wheat yields obtained at Wooster, Strongsville, Germantown, and Carpenter from fertilized and unfertilized plats in 3- and 5-year rotations and for good and bad seasons are tabulated.

An average increase in yield of 40 per cent at Wooster and 50 per cent at the substations was obtained in good seasons from applications of phosphorus and potassium. In bad seasons the increase was from 109 to nearly 200 per cent of the unfertilized yield. A further increase in the number of bushels was realized from applications of nitrogen, but the percentage of the unfertilized yields was smaller in good than in bad seasons.

With nitrate of soda selling at 3 cts. a pound or less, wheat at \$1 per bushel returned the cost of the nitrate in good seasons in all tests except at Strongsville. In bad seasons, however, wheat failed to return the cost of the nitrate at both Strongsville and Germantown. At the present price of nitrate (3.5 to 4 cts. per pound) wheat must bring more than \$1 a bushel to justify its use. The nitrate was in all cases preceded by a full application of acid phosphate; otherwise the crop increase has never paid the cost of the nitrate.

For wheat fields not fertilized in the fall a top-dressing of approximately 200 lbs. of acid phosphate and 50 lbs. of nitrate of soda in April is recommended. Sulphate of ammonia may be substituted for nitrate of soda, although its action is slower than that of the nitrate.

The saving of irrigation water in wheat growing. A. and GABRIELLE I. C. HOWARD (*Agr. Jour. India*, 11 (1916), No. 1, pp. 14-30).—Wheat growing under irrigation in the Quetta Valley, India, is discussed with special reference to the conservation of irrigation water. The fundamental principles of water saving are formulated as follows: (1) Irrigation water should be spread over the largest possible area, as was demonstrated by Widtsoe (*E. S. R.*, 32, p. 784). (2) Heavy waterings reduce the proportion of grain to total crop, causing an increase in the length and weight of straw. (3) The growing period of wheat is lengthened by heavy watering, thus delaying maturity, a very undesirable condition in the Quetta Valley, owing to the rapid rise in temperature and hot, dry, westerly winds. (4) When the water supply is limited the root development of the wheat crop will be deeper, provided the seed bed has been properly prepared. (5) Soil moisture must be preserved by the maintenance of a surface mulch of dry soil, accomplished by shallow harrowing.

Experiments on a somewhat extensive scale are reported in growing wheat with the natural moisture only and with a single irrigation. The yield without irrigation was approximately 23.8 bu. per acre. The single irrigation was applied in September, prior to sowing in October, and showed an increase of 5.8 bu. per acre over the yield obtained from fields receiving 7 irrigations. In addition to the increased yield, much earlier maturity was secured, together with a full development of the chaff color, rarely seen in the native-grown wheat.

Third annual report of the State grain laboratory of Montana. A. ATKINSON, B. W. WHITLOCK, and E. W. JAHNKE (*Montana Sta. Bul.* 113 (1916), pp. 77-100, figs. 21).—The work for the year ended September 30, 1916, is reported, including purity and germination tests of 5,035 samples, a study of the seed value of frosted wheat, and a study of the germinability of seeds at different periods after harvesting.

The weed seed content of samples of alfalfa, clover, timothy, and sweet clover is reported as having greatly increased.

The average field germination of frosted and unfrosted wheat was 75 and 7 per cent, respectively, while the average number of heads per row was 1.52

the frosted wheat and 1.509 for the unfrosted wheat. The grain weight per bushel was 1,457 and 1,375 gm., respectively.

Germination tests of samples of winter and spring wheat, oats, and barley ten one week, one month, and two months after threshing indicate that germination improves greatly a few weeks after threshing.

Twenty-one of the worst weeds encountered in Montana are briefly described and illustrated.

Results of seed inspection, 1915 and 1916, J. P. HELYAR ET AL. (*New Jersey Sta. Bul.* 392 (1916), pp. 3-23).—Continuing work previously noted (E. S. R., p. 832), the author states that during the past two years more attention has been paid to the analysis of vegetable seeds offered for sale in bulk on the New Jersey markets. Analyses of official samples for 1915 include red clover, alfalfa, crimson clover, cowpeas, Canadian field peas, beans, lima beans, sweet corn, radishes, tomatoes, turnips, cucumbers, and cabbages.

The 1916 analysis was confined entirely to vegetable seeds, except for crimson clover seed investigations. A comparison of the analyses of 20 crimson clover samples showed a variation in germination percentage of from 24.5 to 92.5 per cent.

Weeds in the Government of Novgorod, A. MALZEV (*Trudy Biūro Prikl. Bot. (Bul. Appl. Bot.)*, 9 (1916), No. 4, pp. 137-174).—The weeds found in winter rye, spring oats, barley, flax, potatoes, and cabbage in the Government of Novgorod are discussed, those peculiar to each crop listed separately, and all weeds identified (81 in number) listed alphabetically and briefly described. It is pointed out that only about 12 of these weeds are serious pests and that as a rule the annuals are more noxious than the perennials.

Broom rape (*Jour. Bd. Agr. [London]*, 23 (1916), No. 5, pp. 478-481, fig. 1).—This is a note on the parasitic weed broom rape (*Orobancha minor*), which was usually prevalent in English clover fields during the summer of 1916. The history of the plant is briefly outlined, together with preventive and control measures.

Red sorrel and its control (*Bumex acetosella*), F. J. FIPAL (*Indiana Sta. Bul.* 197 (1916), pp. 28, figs. 16).—Red sorrel is described and measures for its control outlined.

An abundance of red sorrel in a field is held to indicate soil acidity, insufficient organic matter or mineral plant food, or inadequate drainage. Potatoes with several types of soils indicated that correction of such unfavorable conditions will stimulate clover production and check the growth of the sorrel, though lime was not found to have harmful effects on the growth of the plant itself.

Other tests indicated that eradication of the weed may be effected by one or more applications in the form of a fine spray of a 20 per cent solution of sulfate of iron or of full strength orchard heating oil. For badly infested fields cultivation or grazing with sheep is recommended, and it is pointed out that adding eradication sorrel may be cut and utilized for feed.

HORTICULTURE.

Proceedings of the American Society for Horticultural Science, 1916 (*Proc. Amer. Soc. Hort. Sci.*, 13 (1916), pp. 162, pls. 3, figs. 6).—In addition to the routine business report, the following papers presented at the annual meeting of the society, held in New York City, December 28 and 29, 1916, are given: Methods of Work in Pruning Investigations, by C. H. Connors (pp. 14-17); Monographic Studies with Flowers, by A. C. Beal (pp. 17-22); *Gardenia*

Studies, by C. H. Connors (pp. 22-30); What Science Has Done and Will Do for Floriculture, by E. A. White (pp. 30-40); The Inheritance and Permanence of Clonal Varieties, by M. J. Dorsey (pp. 41-71); Experiments in Bud Selection with the Apple and Violet at Geneva, by R. D. Anthony and J. W. Wellington (pp. 71-76); Improvement of Vegetable Varieties by Selection, by R. Wellington (pp. 77-80); Variety Testing, by L. C. Corbett (pp. 80-84); Variety Testing at the Dominion Experimental Farms, and What Has Been Accomplished by It, by W. T. Macoun (pp. 85-90); Methods for the Study of Vegetable Varieties and Strains, by P. Work (pp. 91-95); Factors Influencing the Abscission of Flowers and Partially Developed Fruits of the Apple, by A. J. Heinicke (pp. 95-103); Horticulture as a Science and as an Art, by M. A. Blake (pp. 103-106); Influence of Nitrogen in Western Orchards, by C. I. Lewis (pp. 107-110); Report of the Committee on Research and Experimentation: Part I, by L. H. Bailey, Part II, Research and Experimentation, by W. L. Howard, Part III, How to Lay Out an Experiment in Horticulture, by H. J. Webber, and Part IV, Fundamental Training Required for the Successful Undertaking of Research, by W. T. Macoun (pp. 110-120); and Report of Committee on Graduate Courses, by M. J. Dorsey (pp. 120-128).

A list is given of horticultural projects being conducted at institutions with which members of the society are connected.

[Report of the] division of horticulture (*Minnesota Sta. Rpt. 1916, pp. 49-54*).—In the sterility studies with fruits the results with the strawberry indicate that where good pollen is produced in the cultivated varieties the plants are self-fertile. Studies conducted under tent and in the greenhouse show that a number of Burbank-Wolf plum crosses, as well as the Burbank plum, the sand cherry, and the Compass cherry, are self-sterile. Some of the hybrids of these fruits were intersterile. Self-sterility did not appear to be due to aborted pollen or defective nuclei. Studies were made of the flowers of five species of maples. The pollen of the partially suppressed anthers of the functionally pistillate flowers were found to be normal in all five species, but the flowers were self-sterile because dehiscence does not take place in this type of anther.

Of the hardy seedlings at the fruit breeding farm, Minnesota No. 4 raspberry is considered promising as it has sustained no winter injury in the last four seasons. At Deerwood it was not injured by a temperature of -49° F. when left uncovered.

A test of ten varieties of Minnesota apples with reference to their value for cider and vinegar making showed that the apples are relatively low in sugar content but that vinegar of standard grade can be obtained within five months by pressing if kept in reasonably warm quarters.

A study of the most desirable time of the year for pruning apples and plums indicates thus far that success depends more on careful pruning than on the season in which the pruning is done.

Results of the potato investigations at the stations show conclusively that the improvement of seed by any kind of selection is an impossibility when the seed has been affected with curly dwarf. Tests made of potato seedlings and varieties showed in all cases that new stock is superior in productiveness and vigor to the old stock grown for one or more years in the station grounds.

Among the results secured in breeding various vegetables a pure line of Red Globe onion gives promise of being a valuable acquisition, owing to its good keeping quality. The work with squashes indicates the possibility of isolating and fixing a desirable commercial type of the Hubbard squash. In the tomato experiments marked increases in yield were obtained from some of the crosses, and it is believed certain combinations will prove valuable, owing to their earliness, smoothness, and productiveness.

Observations of various hedge plants on the station grounds indicate that the best plants for clipped hedges are buckthorn, *Cotoneaster acutifolia*, and june currant. Hackberry and *Viburnum lentana* have been used with good results under some conditions.

[Report of horticultural investigations at the Crookston substation] (*Minnesota Sta., Rpt. Crookston Substa., 1910-1916*, pp. 70-81).—Tabular data are given showing the number and kinds of fruit trees and shrubs, as well as ornamental trees and shrubs planted at the Crookston substation chiefly during the period 1910-1916, including the number alive in 1916. Much injury and death among the plantings was caused by soil alkali, sun scald, freezing in the fall, and winter injury. The yields secured from variety tests of vegetables during the period of 1911-1916 are also reported, including notes on the best varieties.

[Horticultural work at the Crookston substation] (*Minnesota Sta. Rpt. 1916*, pp. 70, 71).—Notes are given on hardiness, variety, and cultural tests in 1915-16 of windbreak and ornamental trees and shrubs, orchard and small fruits, and vegetables, conducted at the Crookston substation, as noted above.

Report of the work of the horticultural substation, O. B. WHIRPLE (*Montana Sta. Bul. 114 (1916)*, pp. 101-123, figs. 8).—A progress report on orchard culture and variety tests started at the substation in 1908.

The results of cultural experiments taken as a whole show the detrimental effect of continuous clean tillage as maintained during the period 1908-1916, inclusive, and the beneficial effects of leguminous cover crops in building up the fertility of the soil. The variety tests included apples, apricots, cherries, pears, peaches, plums, and walnuts. Notes are given on the behavior and adaptability of different varieties to western Montana conditions.

A fruit survey of Mesa County, E. P. SANDSTEN, T. F. LIMBOCKER, and R. A. GINTY (*Colorado Sta. Bul. 223 (1917)*, pp. 3-52, figs. 12).—The survey here reported was conducted during the summer and fall of 1915. The area surveyed included the portion of Grand Valley, about 75,000 acres in extent, which was irrigated previous to the opening of the Government ditch in 1915. The information secured pertains to various cultural practices, the extent to which they are used, areas in different kinds of fruits, varieties grown, yields, costs, culture, etc. In presenting the results suggestions are given relative to improvement in cultural operations.

The results show that there are nearly 18,000 acres of orchard in the valley, of which 10,000 are apples, 3,000 peaches, 2,400 pears, and the remainder plums, apricots, and cherries. Fewer than one-third of the fruit trees in the Grand Valley are over 12 years old. The orchards as a rule were found to be too small to be profitable, the average size being slightly below 9 acres. The authors recommend that more land be devoted to general farming, stock raising, and dairying, and that the average fruit grower include other crops besides fruit. It is estimated that more than 2,500 acres of orchard have been pulled up during the last five years. The estimated average cost of production per box of fruit laid down at the shipping station is for apples 61.2 cts., pears 60.5 cts., and peaches 31.2 cts.

Fruits, trees, and shrubs recommended for northern Minnesota, T. M. McALL (*Minnesota Sta., Rpt. Crookston Substa., 1910-1916*, pp. 88-91).—The varieties given are listed in order of adaptability as shown by work at the Northwest Substation at Crookston and results obtained by growers in different parts of northern Minnesota.

Dependable fruits: Apples, pears, plums, peaches, cherries, small fruits, J. GREEN, P. THAYER, and J. B. KEEL (*Ohio Sta. Bul. 313 (1917)*, pp. 603-4, pl. 1).—This bulletin includes varietal lists prepared by the station of apples, pears, plums, peaches, cherries, and small fruits recommended for

culture in Ohio. The selection of the varieties here suggested for culture is based upon experience covering 25 years in the station orchard, in orchards of co-operators, and on observation and study of horticultural problems in various sections of the State.

Annual report of the Fruit Experiment Station, Shillong, for the year ended June 30, 1916, C. H. HOLDER (*Ann. Rpt. Agr. Expt. Stas. Assam, 1916, pp. 64-85*).—Tabular data are given showing the number and kinds of orchard and small fruits in the station nurseries and orchards.

Pruning, F. M. CLEMENT and F. S. REEVES (*Ontario Dept. Agr. Bul. 248 (1917), pp. 36, figs. 78*).—A practical treatise on methods of pruning fruit trees, vines, and bushes.

Apple breeding at the university experiment station, C. S. CRANDALL (*Trans. Ill. Hort. Soc., n. ser., 50 (1916), pp. 444-451*).—A popular summary of progress made in apple breeding investigations which have been under way at the Illinois Experiment Station since 1907.

One phase of the work comprises an attempt to determine whether varieties of apples are affected through propagation from selected buds. The results secured indicate in brief that just as good trees are grown from small buds as from large buds, and there is no evidence that it makes any difference from which location on the tree or shoot the bud may be taken. Buds from water sprouts are equal to buds from top terminal shoots.

Field experiments in spraying apple orchards in 1916, A. J. GUNDERSON and W. S. BRACK (*Illinois Sta. Circ. 194 (1917), pp. 8-15*).—The experiments here summarized were conducted to determine the relative values of Bordeaux and lime-sulphur in the control of apple blotch, the relative merits of dust and liquid spraying in the control of insects and fungi, and the value of the cluster-bud spray in the control of scab. A more detailed account will appear in a later publication.

Although Bordeaux caused some russetting of the fruit and a small amount of foliage injury, it proved superior to lime-sulphur as a spray for blotch, probably because of its greater adhesiveness. It was thus effective over a longer period of time than lime-sulphur. Dust mixtures were less efficient than the liquid sprays in the control of fungi, but apparently controlled the codling moth and curculio equally as well as the liquid sprays. The prebloom or cluster bud spray was valueless in the control of scab where the infection was not present the preceding season. Bordeaux applied just before the bloom was no more efficient than lime-sulphur arsenate of lead in the control of apple scab. On one plot where arsenate of lead was used alone throughout the season scab infection was reduced materially.

Based on results of the experiments, spray schedules are given for different sections of Illinois, together with formulas and methods of preparation. •

Dominion experimental orchard work, W. S. BLAIR (*Ann. Rpt. Fruit Growers' Assoc. Nova Scotia, 1917, pp. 132-159*).—The results are given of cooperative spraying experiments conducted under the direction of the Kentville station in 1916.

The investigations as a whole show that four regular lime-sulphur arsenate sprays, the first of which is applied when the buds have burst and the leaves are partly open, the second when the blossom clusters have separated and before the petals have opened, the third when 90 per cent of the petals have fallen, and the fourth about ten days after the third spray, are necessary for the best control of apple scab. If three applications only can be made, a thorough application should be given midway between the time for the first and second sprays. If only two applications can be made, the one before and the one after the blossoms will give the best results.

In view of the less serious injury from burning, lime-sulphur lead arsenate was more satisfactory than other sulphur lead arsenate sprays and Bordeaux lead arsenate sprays. The kind of nozzle was not a factor in causing foliage injury, provided an equal amount of spray was applied. A heavy application of lime-sulphur lead arsenate is liable to cause foliage injury, whereas the regular application will cause very slight, if any, injury.

In order to avoid the injury from the drench spray of the combined nicotine sulphate and lime-sulphur lead arsenate used for the green apple worm, it seems necessary to reduce considerably the strength of the lime-sulphur solution. Lime-sulphur weaker than the standard 1.008 or 1:37 is not so effective for scab control.

The culture of small fruits on irrigated sandy land, R. W. ALLEN (*Oregon Sta. Bul. 142* (1917), pp. 5-14, figs. 2).—The results of varietal and cultural experiments with strawberries, together with variety tests of currants, gooseberries, dewberries, raspberries, and blackberries, conducted at the Umatilla substation are here briefly stated, and cultural directions are given for growing small fruits based on the substation's work.

Fruiting habits of budded trees of the different avocado varieties, T. U. BARBER (*Rpt. Cal. Avocado Assoc., 1916*, pp. 98-103 fig. 1).—A list is given of varieties of budded avocado trees which are fruiting in California and the age that they started to bear, together with a discussion of different characteristics of growth. The data given are based upon reports from members of the California Avocado Association.

Cultural experiments with the filbert in the East, J. S. MCGLENNON (*Amer. Nut Jour., 6* (1917), No. 5, p. 71).—A brief statement of results secured in propagating and growing filberts during the past three seasons, including a list of varieties grown.

Analyses of materials sold as insecticides and fungicides for 1916, C. S. CATHCART and R. L. WILLIS (*New Jersey Stat. Bul. 301* (1916), pp. 5-16).—The results are given of analyses of various samples of Paris green, lead arsenate, lime-sulphur, Bordeaux mixture, and miscellaneous materials inspected by the station during the year 1916.

FORESTRY.

The training of a forester, G. PINCHOT (*Philadelphia and London: J. B. Lippincott Co., 1917*, 3. ed., rev., pp. 157, pls. 8).—In the present edition of this work (E. S. R., 30, p. 742) the facts and figures have been revised throughout and brought up to date, and a new chapter containing some essential information about American forests has been added.

The theory and practice of working plans, A. B. RECKNAGEL (*New York: John Wiley & Sons, 1917*, 2. ed., rev., pp. XIV+265, pls. 6, figs. 8).—The present edition of this work (E. S. R., 28, p. 644) has been thoroughly revised to embody the recent developments in forest organization.

Determining the quality of standing timber, S. BERRY (*Jour. Forestry, 15* (1917), No. 4, pp. 438-441).—An account of methods of determining the value of stands involved in stumpage appraisals as used in District 5 of the Forest Service of the U. S. Department of Agriculture.

Forest tree planting camps, J. S. ILLICK (*Jour. Forestry, 15* (1917), No. 4, pp. 394-409).—In this article the author describes the methods employed by the Pennsylvania forest department in the establishment and operation of tree planting camps.

Eleventh report of the forest commissioner of the State of Maine, 1916, F. E. MACE (*Rpt. Forest Comr. Maine, 11* (1916), pp. 157, pls. 13, fig. 1).—This report embraces various forest activities in Maine during 1915 and 1916,

including work of forest protection, forest extension and improvements, and forest education. A statement by G. B. Posey of the U. S. Department of Agriculture relative to the extent and distribution of the white-pine blister rust in Maine is also included.

The conservation law as amended to the close of the regular session of 1916 (*Albany, N. Y.: State, 1916, pp. 409*).—This comprises the conservation law of the State of New York dealing with the administration of lands, forests, and parks, fish and game, waters, and the State reservation at Saratoga Springs.

Report of the forestry branch (*Rpt. Min. Lands, Forests and Mines, Ontario, 1916, pp. 146-151, pl. 1*).—A brief report on forestry nursery work, white pine blister rust inspection, and railway fire protection in Ontario for the year ended October 31, 1916.

Fifty years of forest administration in Bashahr, H. M. GROVER (*Indian Forester, 41 (1915), No. 11, pp. 398-407, pls. 4; 42 (1916), No. 3, pp. 119-129, pls. 2*).—In the present article the author considers the general effects of regular management during the last 50 years on the forests of Bashahr State, India, and the way in which the development of the forests has reacted on the prosperity of the State.

Notes on the forests of Algeria, MARC (*Notes sur les Forêts de l'Algérie. Algiers: Gouvern. Gén. Algérie, Dir. Forêts, 1916, pp. 353, pls. 15*).—This work comprises as a whole a report on the past and present status of forestry in Algeria. The subject matter is presented under the following general headings: Forest revenues, the cork harvest, the forests and the transportation tariffs, forest activities from 1902 to 1914, forest fires in Algeria, measures taken in favor of the natives, lands withdrawn from the forest reserve from 1892 to 1915, and the accessory functions of the forest service in Algeria.

A discussion of Australian forestry, with special reference to forestry in western Australia, the necessity of an Australian forest policy, and notices of organized forestry in other parts of the world, together with appendices relating to forestry in New Zealand, forestry in South Africa, and control of the rabbit pest, D. E. HUTCHINS (*Perth, Aust.: Govt., 1916, pp. XXIII+434, pls. 17*).—The present discussion embraces the results of a survey of forestry and forest conditions in Australia conducted under the auspices of the government of western Australia. Although special consideration is given to the forests of western Australia, the subject matter deals also with forestry in all the States of the Commonwealth and New Zealand.

Correlation between the light and soil requirements of a species for its natural regeneration, B. O. COVENTRY (*Indian Forester, 43 (1917), No. 4, pp. 186-194*).—A discussion of this subject with special reference to Indian species of trees. The principal species are here classified with reference to both light and soil requirements.

The biology of lodgepole pine as revealed by the behavior of its seed, C. G. BATES (*Jour. Forestry, 15 (1917), No. 4, pp. 410-416*).—The author briefly reviews the nature and results of seed production, extraction, and germination tests with lodgepole pine conducted by the Forest Service of the U. S. Department of Agriculture, and presents some deductions based on these experiments relative to the biology of lodgepole pine.

The Mexican and Central American species of *Ficus*, P. C. STANDLEY (*U. S. Nat. Mus., Contrib. Nat. Herbarium, 20 (1917), pt. 1, pp. VIII+35*).—This comprises a systematic description of the Mexican and Central American species of *Ficus*. Forty-one species are here enumerated, of which only two are common to the West Indies and Central America.

Forest and shade trees and basket willows recommended for planting in Idaho, C. H. SHATTUCK (*Idaho Sta. Circ. 4 (1917), pp. 4*).—A descriptive list

of trees recommended for various planting purposes in Idaho, including a price list of trees which the department of forestry of the station is prepared to furnish the residents of the State.

The status and value of farm woodlots in the eastern United States, E. H. BOTHINGHAM (*U. S. Dept. Agr. Bul. 481* (1917), pp. 43, pl. 1, figs. 2).—The purpose of this bulletin is to show as nearly as can be done from available census statistics what the relation of the woodlot has been to the agricultural development of different parts of the East, what the tendencies appear to be, and, in general, what value the woodlot actually has to the Nation, the rural community, and the individual farm. The subject matter is presented under the general headings of woodlots of the Eastern States, how the growth of farming is affected the woodlot, amount and quality of woodlot timber, what the woodlot promises for the future, and the woodlot as a farm resource. In addition considerable tabular data maps are given showing the proportion of woodlot to total farm land in different sections of the East and the actual farm woodland area in the United States in 1910 by counties.

Canadian woods for structural timbers, H. N. LEE (*Dept. Int. Canada, Forestry Branch Bul. 59* (1917), pp. 44, figs. 22).—This bulletin gives a sketch of the forest resources of Canada and discusses the qualities that affect the usefulness of timber for structural purposes. Descriptions are then given of the chief Canadian species suitable for this purpose and comparisons, tables, and charts relating to mechanical and physical tests. The bulletin concludes with short discussion of the grading of timber.

Forest products of Canada, 1913, 1914, and 1915, R. G. LEWIS ET AL. (*Dept. Int. Canada, Forestry Branch Buls. 52* (1915), pp. 79, pls. 2, figs. 5; 57 (1916), pp. 82, pls. 3, figs. 7; 58 (1917), pp. 72, pl. 1, figs. 8).—These comprise statistical reports for the years 1913, 1914, and 1915, respectively, relative to the use of lumber, lath and shingles, pulpwood, poles, and cross-ties throughout the Dominion. The production is given both by Provinces and by kinds of wood.

The recent industrial and economic development of Indian forest products, S. PEARSON (*Jour. Roy. Soc. Arts, 65* (1917), No. 3366, pp. 487-493).—A paper on this subject read before the Indian section of the Royal Society of Arts in April, 1917.

DISEASES OF PLANTS.

The susceptibility of cultivated plants to diseases and pests, P. E. KRYZENIUS (*Teysmannia, 27* (1916), No. 1-2, pp. 65-77).—This is a somewhat general discussion, with illustrative examples, of the several degrees of parasitism of economic plants, namely, infectious induced by weakness, injury, or true parasitic activity of the attacking organism with the circumstances favorable thereto, as virulence, stage of development of host or parasite, physical conditions, and specializations.

Studies in the physiology of parasitism, W. BROWN (*Jour. Bd. Agr. [London], 23* (1916), No. 5, pp. 474-478).—This is a summary of work done and results obtained by the author and by Blackman and Welford as previously noted (*E. S. R., 37*, p. 47).

A study of Glomerium, KÄRGER (*Mitt. K. Biol. Anst. Land u. Forstw., No. 15* (1914), pp. 15, 16).—A brief review is given of a few species (with their hosts) of *Glomerium*, of which *Colletotrichum* is treated as a subgenus.

Further evidence as to the relation between crown gall and cancer, E. F. SMITH (*Proc. Nat. Acad. Sci., 2* (1916), No. 8, pp. 444-448).—Previous opinions are reviewed regarding cancer in animals and crown gall in plants. The author states that if inoculations with *Bacterium tumefaciens* are made in

regions not previously known to contain totipotent cells such as supposedly originate tumors on inoculation in the neighborhood of dormant buds, tumors are produced too numerous to be explained as due to the development of embryonic "cell rests" or what are conceived to be fragments displaced from the embryo in early stages of growth and remaining dormant amid other tissues. It is claimed that embryomas are the results of specific tissue response to the stimulus of a specific schizomycete, taking the embryoma form if a complex anlage containing totipotent or nearly totipotent cells is involved. The conclusion is regarded as almost unavoidable that cancer is due to a parasite and that, as shown in case of plants, this parasite may be found to give rise to the most diverse forms of the abnormality.

Report of the pathologist, J. A. STEVENSON (*Rpt. Bd. Comrs. Agr. P. R.*, (1915-16), pp. 35-74).—In addition to an account of routine work of the laboratory, the author gives descriptions of citrus and sugar cane disease observed in Porto Rico. Notes are also given on a number of minor diseases among them root knot of various ornamental and other plants, trunk rot of *Ficus nitida* due to *Nummularia bulliardii*, a root rot of avocado caused by an undetermined fungus probably of the *Nummularia* group, together with notes on entomogenous fungi.

[Reports on botany and plant diseases in Switzerland, 1913-14], H. MÜLLER-THURGAU ET AL. (*Landw. Jahrb. Schweiz*, 29 (1915), No. 5, pp. 476-484, 503-522, 574, 575, 578, 579, 593, 594).—The sections here noted relate to observations and experiments in connection with various phases of botany and plant parasitism, including disease resistance and injury by nematodes as well as by other animal pests.

Notes are given on a number of rather common parasites observed on various economic plants, the information being grouped according to whether the hosts are orchard, garden, or ornamental plants. There are also brief accounts of special studies on sugar in floral leaves; acetaldehyde formation in orchard fruits; hydrofluoric acid injury to grapes; cases of *Phytophthora* disease; control of *Pseudopeziza tracheiphila* on grapevines; *Gnomonia* on cherry leaves; control of *Oidium euonymi japonicae*; a dieback of young plum trees probably due to root fungi; injury to ornamental plants by *Aphelenchus ormerodii* and *Tylenchus dipsaci*; and control of grape *Peronospora*, leaf roll of grape, and *Sphaerella fragariae* on strawberry.

Fungus parasites of the higher plants in the region of Kharkov and adjacent provinces, A. A. POTEBNIA (*Kharkov. Oblast. Sel'sk. Khoz. Opytn. Stn. Fitopatol. Otd.*, No. 1 (1916), pp. 121-251, figs. 21).—In continuation of a previous report (*E. S. R.*, 35, p. 453) an account is given of the ascomycetous parasites up to and including in part the Erysiphaceae.

Of the Exoascace, species of *Taphrina* (in which the author includes the members of *Exoascus*) are found on a large number of hosts in four different families. Among Discomycetes, species of *Sclerotinia* and *Pseudopeziza* appear to be most prevalent. Particular attention is called to the occurrence of a little-known parasite, *Phacidella discolor*, found on pear, apple, and *Pyrus pashia*. This fungus causes serious trouble, however, only in case of apple, killing the bark on the trees and thus producing large wounds.

Diseases and pests of cultivated plants in the Dutch East Indies in 1915. C. J. J. VAN HALL (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten*, No. 20 (1916), pp. 47).—An account is given of diseases and animal enemies affecting a large number of orchard, garden, forest, and field plants in Java during the year, with control measures employed or recommended, together with a list of phytopathological literature which appeared in 1915 relating to the Dutch East Indies.

Control measures against plant diseases and injurious insects, C. J. J. VAN HALL, A. A. L. RUTGERS, and K. W. DAMMERMAN (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 17 (1915), pp. 42, figs. 20*).—This is a discussion of a large number of preparations, with devices and appliances for their employment, for the control of diseases and animal enemies of various plants in Java.

Tests of new fungicides, E. RIEHM (*Mitt. K. Biol. Anst. Land u. Forstw., No. 15 (1914), pp. 7, 8*).—The results are detailed of tests, principally with new mercury preparations offered as means of combating cereal diseases, particularly *Tilletia tritici* on wheat and *Helminthosporium graminum* on barley.

Tests of fungicides with cereal diseases, E. RIEHM (*Mitt. K. Biol. Anst. Land u. Forstw., No. 16 (1916), pp. 8, 9*).—The experiments noted above have been continued. The tests with mercury chlorophenol against *Helminthosporium graminum* are said to have proved the adequacy of this fungicide in his connection. Chinosol proved less effective at safe concentrations. Mercury chlorophenol at 0.2 per cent concentration applied to seed grain for 10 minutes, or at 0.1 per cent for 15 minutes, controlled stinking smut as completely as did formaldehyde, copper sulphate, or corrosive sublimate, but it appeared to be ineffective against loose smut of barley.

Overwintering of stinking smut in soil, O. APPEL and E. RIEHM (*Mitt. K. Biol. Anst. Land u. Forstw., No. 15 (1914), p. 6*).—Spores of stinking smut in samples of soil from various localities could not be made to germinate in spring by any means employed.

Diseases and pests of rice, A. A. L. RUTGERS (*Teymannia, 27 (1916), No. 6, p. 313-342*).—Influences discussed as local causes of loss to rice interests include root rot (soil conditions), head rot (climate or weather), *Tilletia horrida*, *Ustilaginoides viridis*, *Sclerotium rolfsii*, fungus leaf spotting, and various insects and birds.

Treatment of loose smut of wheat and barley, O. APPEL and E. RIEHM (*Mitt. K. Biol. Anst. Land u. Forstw., No. 15 (1914), pp. 5, 6*).—After two hours in hot water and two more in moist air, wheat seed infected with loose smut showed a degree of infection amounting to 1 per cent. Complete freedom from infection was obtained by treating infected wheat or barley seed with 0.1 per cent corrosive sublimate for one hour, also by use of the combined treatment consisting of four hours in water at 25 to 30° C. and 10 minutes at 50 to 52°, likewise by use of the treatment in which barley seed are kept in water at 45° or two hours.

A wheat disease caused by *Dilophospora graminis*, L. MANGIN (*Bul. Soc. Path. Veg. France, 1 (1914) No. 1, pp. 55-77, pl. 1*).—An account is given of the destructive effects on wheat of *D. graminis*. *Dilophia graminis* and *Mastigosporium album*, supposed to be other forms or stages of this fungus, are more or less common in wild grains, which may thus become sources of infection for wheat and perhaps oats, if not other crops.

[Wheat rust in New Zealand], R. WATERS (*Jour. Agr. [New Zeal.], 13 (1916), No. 1, pp. 41-46, fig. 1*).—Wheat rust, though present to some extent every season in New Zealand, is rarely widespread and severe, but a period of exceptional severity in this respect was experienced in the neighborhood of Invercargill, Bruce County, South Otago, where yields were so greatly reduced as to be worthless in some cases. Volunteer oat plants in some badly rusted wheat fields showed practically no signs of rust.

Barberry is rare in many parts of New Zealand and it is not known to bear the fungus producing the æcidiospores of the wheat rust fungus, the usual mode of overwintering possibly being omitted in this case. It is believed that the summer spores infect the volunteer plants and autumn crops and that the

spores produced thereon infect the spring crops. The Greenfield outbreak is thought to have originated from a crop planted in autumn.

The relation of weather to the development locally of the fungus is discussed, as are also subordinate related factors and some proposed methods of treatment, which include destruction of all aftermath and self-sown grain with avoidance of autumn and late spring sowing and of heavy nitrogen fertilizing.

Stalk disease of wheat, E. FOEX (*Bul. Soc. Path. Veg. France*, 1 (1914), No. 1, pp. 26-30, pl. 1).—A brief discussion is given of foot disease of cereals, said to be due principally to *Ophiobolus graminis*, which works around the base of the stalk, and to *Leptosphaeria herpotrichoides*, appearing higher on the stem, around which it also works its way more gradually. *O. herpotrichus* has been observed to cause stem weakening in cereals, as has also *Cercospora herpotrichoides*, which has been considered a conidial form of *Leptosphaeria*. Germination tests with these fungi are discussed.

Diseases of beans, W. G. SACKETT (*Colorado Sta. Bul.* 226 (1917), pp. 21-31, figs. 6).—Descriptions are given of a number of diseases of beans known to occur in Colorado, with suggestions for their control.

Among the more troublesome diseases are bacterial blight (*Pseudomonas phaseoli*), pod spot or anthracnose (*Colletotrichum lindemuthianum*), bean rust due to *Uromyces appendiculatus*, and a new disease to which the name bean streak has been given. The last disease was first observed in Colorado in the summer of 1916. It attacks stems, leaves, and pods, producing symptoms similar to those present in plants affected with bacterial blight. On the pods rusty, orange-brown discolorations later appear. The leaves are destroyed and the plants become defoliated before the crops mature. The cause and methods of control are being further investigated.

Control of clubroot of crucifers, O. APPEL and O. SCHLUMBERGER (*Mitt. K. Biol. Anst. Land u. Forstw.*, No. 15 (1914), pp. 13-15).—Among the more favorable results tabulated as obtained from tests of preparations for reducing infection of cruciferous crops by *Plasmidiophora brassicae* in the soil, those given by 2 or 3 per cent formalin and those by certain proprietary preparations were almost equal in value.

Phoma disease in crucifers, R. LAUBERT (*Mitt. K. Biol. Anst. Land u. Forstw.*, No. 16 (1916), pp. 10-12, fig. 1).—It is considered probable that the same species of Phoma causes the more or less similar diseases of different cruciferous plants noted during recent years at points in Holland, France, Germany, Australia, and North America.

Corynespora melonis, KUTGER (*Mitt. K. Biol. Anst. Land u. Forstw.*, No. 15 (1914), pp. 16, 17).—*C. melonis*, the cause of leaf scorch of cucumbers, said to cause loss in England, Holland, and Germany, is briefly described and discussed as to effects and dispersal, with suggestions regarding seed disinfection.

Flax blight, G. ARNAUD (*Bul. Soc. Path. Veg. France*, 1 (1914), No. 1, pp. 38-41, fig. 1).—*Asterocystia radialis* is said to cause a blight of cultivated flax in Flanders by attacking the roots and lowering water absorption. The intracellular behavior of the fungus is described. Alkalis seem to favor, acids to hinder, its development. Fungicides are difficult of application. Rotation of crops is recommended, though the parasite attacks also a number of common crops, which are named.

Studies in the dying out of pepper vines in the Dutch East Indies.—II. Pepper culture on Banka, A. A. L. RUTGERS (*Dept. Landb., Nije. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten*, No. 19 (1916), pp. 36, pls. 17).—This contribution, in continuation of one previously noted (E. S. R., 35, p. 349), besides giving a brief history of pepper culture and its forms and characteristics on the island of Banka, deals briefly with such drawbacks as

suitable soil and animal and plant parasites, including nematodes (*Heterodera* *nicotiana*) and an unnamed cobweb fungus on the leaves.

Potato diseases in the Dutch East Indies, JOHANNA WESTERDIJK (*Teyssonia*, 27 (1916), No. 1-2, pp. 1-16, pl. 1).—This is a discussion of potato diseases, culture, and diseases with related protective measures. The diseases include *Phytophthora infestans*, *Macrosporium solani*, leaf roll, a leaf rust, and a root fungus.

Experiments for control of potato canker, E. WERTH (*Mitt. K. Biol. Anst. Land u. Forstl.*, No. 16 (1916), pp. 9, 10).—Experiments with sulphur on the potato varieties Wohltmann, Silesia, and Industry gave a lowering of canker infection amounting to less than one-third, accompanied by a decrease of more in three-fourths in yield. Tests for resistance showed less than 10 per cent susceptibility in Kaiserkrone, Richter Imperator, Fürstenkrone, Gertrud, and Jolly, and Paulsen July.

Potato leaf roll in France, E. FOEX (*Bul. Soc. Path. Veg. France*, 1 (1914), No. 1, pp. 42-48).—Potato leaf roll is said to attack severely several varieties of potato in the canton of Orchies in northern France.

Potato leaf roll, O. APPEL and O. SCHLUMBERGER (*Mitt. K. Biol. Anst. Land u. Forstl.*, No. 15 (1914), pp. 8-11, fig. 1).—The authors continue to report on a study of potato leaf roll previously noted (E. S. R., 27, p. 247; 28, p. 52; 29, p. 52; 34, p. 443). The results obtained by planting the diseased stock from different sources on various soils were not consistent throughout. Improvement was noted in some cases, while in others the leaf roll appeared later in the season.

Chlorosis of beets, G. ARNAUD (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 2, pp. 123, 124).—Describing the foliar discoloration in sugar beets previously noted by Berthault (E. S. R., 35, p. 350) and by Miège (E. S. R., 36, p. 543), the author states that the trouble was somewhat general in the north of France during 1915. It is thought that the phenomenon is related causally to the valence of *Cercospora beticola*, *Uromyces betae*, *Phoma tabifica*, and leaf withers, in connection with lack of water, cultivation, and fertilizers, and with the seedling.

Brown gall of sugar beets, PETERS (*Mitt. K. Biol. Anst. Land u. Forstl.*, No. 16 (1916), pp. 12, 13, fig. 1).—In 1912, beets penetrated to a depth of 2 to 3 m. with a needle which had been dipped in cultures of *Bacillus tumefaciens*. The results were partial, or doubtful, results. On repeating the tests the next year, however, and using also shallower penetration (0.5 to 1 cm.), a high percentage of the plants so treated developed crown gall, while the controls were free from argemones.

Sweet potato diseases, J. A. MCCLINTOCK (*Virginia Truck Sta. Bul.*, 22 (1917), pp. 455-486, figs. 14).—Popular accounts are given of diseases of the sweet potato, with suggestions for their control.

The diseases are classified according to the part of the plant involved as those of the above-ground parts, those of the roots, and those of both vines and roots. For the control of many of the diseases, and especially of the more destructive ones affecting both vine and roots, the author recommends careful selection of seed tubers, their treatment with corrosive sublimate solution, and planting seed beds in which clean sand has been substituted for soil. The cuttings should afterwards be planted in soil that is known to be not infected or where sweet potatoes have not been planted for several years.

Clerotium disease of tobacco, JOHANNA WESTERDIJK (*Meded. Delt-Proefst. Medan*, 10 (1916), No. 2, pp. 30-40, pls. 2).—A study of a disease of young tobacco, carried on at the Deli Station, is said to indicate that the trouble is

due to *S. rolfsii*, which flourishes on wild *Crotalaria* and probably on various other legumes which may be found growing with tobacco.

The parasitism of *Coryneum* on trees and shrubs, G. ARNAUD (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 1, pp. 64-70, figs. 3).—This is a bibliographic discussion of several species of *Coryneum* on different hosts named in relation with several other fungus forms.

Hail effects on trees, G. ARNAUD (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 2, pp. 121, 122, pl. 1).—Injuries, particularly to young trees, due to hail driven by strong wind in May, 1915, and observed in July and in October of that year, are described, and resemblances and differences are noted between such injury and the characteristic effects of fungi, in particular *Nectria ditissima*.

Behavior of apple canker in two grafts differing in susceptibility on the same stock, P. A. DANGEARD (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 2, pp. 127, 128).—A case is noted in which two varieties of apple, one very susceptible to *Nectria* and usually developing canker, and the other ordinarily very resistant thereto, were grafted on the same stock. The resulting growths both showed canker, the originally resistant one, however, in lesser degree. After the removal of the more susceptible half, the new growths on the other portion were free from *Nectria*.

A new *Oospora* on pear, L. MANGIN (*Bul. Soc. Path. Veg. France*, 3 (1916), No. 1, pp. 9-11, figs. 2).—A brief account is given of a fungus attacking pear leaves and branches. It is considered a new species and described under the name *O. piriicola*.

Biological observations on pear rust, A. TROTTER (*Riv. Patol. Veg.*, 8 (1916), No. 3, pp. 65-76).—A study of pear rust (*Rustelia cancellata*), carried out near Avellino, has convinced the author that normally the fungus can not winter in that host but that its persistence from year to year in a given locality requires the presence of an alternate host. *Juniperus sabina* is noted as sustaining such relation in this locality, though several other junipers are known to harbor the fungus.

Disease of apricots in the Rhone Valley, J. CHIFFLOT and MASSONNAT (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 2, pp. 117-120).—This has been previously noted (E. S. R., 35, p. 249).

Some observations on witches' brooms of cherries, H. SCHMITZ (*Plant World*, 19 (1916), No. 8, pp. 239-242).—The author, noting the results of observations and tests made in the course of a microchemical study of witches' brooms of cultivated cherries due to *Exoascus cerasi*, holds these results to sustain the claims that witches' brooms elaborate much or all of the food materials needed for their own growth. The increased amount of stored food and resulting high osmotic pressure may account for the prolonged and rapid growth of the diseased parts. The fungus disturbs the normal periodicity of the affected region. Chlorophyll is only masked by the red color in the leaves on the broom. The red color is due to acidity in the leaves, which acidity may itself be due either to the hydrolytic influence of the fungus on the stored material or on the cell walls, or to an influence exerted by the fungus in prolonging the embryonic condition of the leaves and twigs, since even the leaves of the brooms lose their red color upon becoming fully mature.

The biology of *Exoascus deformans* and preventive treatment of peach leaf curl, V. FELLION (*Staz. Sper. Agr. Ital.*, 49 (1916), No. 3-4, pp. 200-218; abs. in *Riv. Patol. Veg.*, 8 (1916), No. 3, pp. 88, 89).—The important means of preservation and transmission of *E. deformans*, the peach leaf curl parasite, is said to be the ascospores, the effectiveness of these depending largely upon atmospheric conditions. The fungus is best controlled during the winter rest

the trees by employing a spray made up of 2 per cent copper sulphate, 1 per cent lime, and 0.2 per cent ammonium chlorid.

A substitute for self-boiled lime-sulphur and other summer sprays for peaches. L. G. GILLAM (*New Jersey Stas. Circ.* 63 (1917), pp. 2-4).—Directions are given for the preparation of a summer spray for peaches to be used as a substitute for self-boiled lime-sulphur. This fungicide is composed of 8 lb. fine sulphur, 4 lbs. hydrated lime, and 1½ oz. ground glue dissolved in 3 l. water, the whole diluted with water to make 50 gal. In the preparation of the spray the dry sulphur and lime should be mixed, then thoroughly incorporated with the glue solution before the addition of the water.

A test of this fungicide proved its value for preventing scab and brown rot without injury to the trees.

On a new canker disease of *Prunus yedoensis*, *P. mume*, and other species caused by *Valsa japonica* n. sp., T. HEMMI (*Jour. Col. Agr. Tohoku Imp. Univ.*, 7 (1916), No. 4, pp. 257-319, pls. 4).—An account is given of a study on a disease first noticed in Sapporo in 1913 and at present limited to Hokkaido. It is common on *P. yedoensis*, *P. sachalinensis*, and *P. mume*, and is found also on *P. persica* and other species of *Prunus*. The trouble is said to be due to a new species of fungus of the subgenus *Euvalsa*, which has been named *japonica*. It may simply cause a canker or else a girdling disease of a different type on the branches.

In the saprophytic condition *V. japonica* seems almost omnivorous. As a parasite it attacks its host most readily through old wounds having a layer of dead cells. Gummosis always develops as a result of the invasion.

Treatment with copper sulphate and sodium carbonate appears to be ineffective. Corrosive sublimate at from 0.05 to 0.1 per cent is the most effective fungicide employed in this connection.

Dieback in currant, O. APPEL and E. WERTH (*Mitt. K. Biol. Anst. Land u. Forstb., No. 16* (1916), pp. 13, 14).—A dieback of currant bushes, extending from a center and increasing the second year (resistance differing with varieties), is ascribed to *Plowrightia ribesia*. Somewhat different from this fungus as to mode of development, but resembling each other in some ways, are dieback diseases ascribed respectively to *Botrytis cinerea* and to *Pleonectria erodolensis*, to both of which all varieties appear to be about equally susceptible.

Peronospora in 1915, and its control, A. MARESCALCHI (*Ann. R. Accad. agr. Torino*, 58 (1915), pp. 349-357, figs. 7; abs. in *Riv. Patol. Veg.*, 8 (1916), no. 3, pp. 81, 82).—The very violent outbreaks of downy mildew occurring May 24 and 25, June 4 and 5, and June 27 and 28, with one of lesser violence May 10 to 12, are said to be closely connected with the high temperature, humidity, and cloudiness which were common in 1915, but not so closely with the actual amount of precipitation. The author points out the necessity for an early and effective dissemination of information regarding the imminence of mildew attack and the necessity for timely spraying.

Treatment of *Peronospora* during 1915, E. C. D'ALBARETTO (*Ann. R. Accad. agr. Torino*, 58 (1915), pp. 304-312).—Giving an account, with discussion, of experiences in connection with the unusually violent grape downy mildew outbreaks of 1915, the author states that while in some cases from 10 to 20 sprayings were ineffective as regards control, five sprayings with the ordinary copper solutions controlled the mildew with a great saving of materials and labor. The precise observance of the prescribed manner and times of spraying is thought to be essential to success in dealing with grape downy mildew and to be sufficient even in years of unusually unfavorable conditions.

The germination of the winter spores of *Plasmopara viticola*, L. RAVAT and G. VERGE (*Bul. Soc. Path. Veg. France*, 1 (1914), No. 1, pp. 51-54).—This is a summary of the development and existing state of knowledge regarding the autumn, winter, and spring behavior of *P. viticola* on *Vitis vinifera*.

The present status of the coconut bud rot disease, J. R. JOHNSTON (*Habana* 1916, June, pp. 8, fig. 1).—The author states that coconut bud rot is an internal disease of the terminal bud. This fact precludes the employment of pruning, except in the initial state (which it is practically impossible to determine), and also the external use of germicides. The slow growth of the tree, moreover, practically prevents the employment of breeding for resistant varieties.

In Cuba, for which somewhat complete records have been obtained and summarized herein, the disease was destructive as early as 1886. It is also said to have been reported as causing, or as having caused, loss in British Guiana, Jamaica, Trinidad, the Cayman Islands, and the lesser Antilles, but its presence is denied or doubted in some other localities which are mentioned.

Fungi parasitic on the tea plant in northeast India, V. VI, A. C. TUNSTALL (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1915, Nos. 1, pp. 12-16; 3, pp. 53-56).—Continuing the series of reports previously noted (E. S. R., 33, p. 650), the author states that *Exobasidium vexans*, the cause of blister blight, attacks leaves and stems and, in general, only young succulent growths of tea plants and no jungle plants so far as known. The spores die after two or three days and the fungus a little later. It is thought, therefore, that the fungus has no dormant stage. On many tea gardens in Assam the disease dies out spontaneously. In the hilly districts, bushes in damp, shady places may show the blisters at any time of the year. Under favoring conditions, the disease may spread with great rapidity.

Pomox lucidus is a common cause of root disease in tea bushes. *Pestalotia palmarum* causes a gray blight of alder leaves and is sometimes found on the stems. The fungus is common in the jungle on both dead leaves and living plants, but it does little harm so long as the plants are healthy. A dieback of weakened plants is due to at least one species of *Glæosporium*. A closely similar disease ascribed to *Colletotrichum camelliae* is prevented by sprays and soil improvement. Internal root disease is ascribed to various species of *Diplodia*, the commonest being *Botryodiplodia theobromæ*, a fuller report of which is to be given later.

Tumors on *Chrysanthemum frutescens*, R. LAUBERT (*Mitt. K. Biol. Anat. Land u. Forstw.*, No. 15 (1914), p. 17).—The author notes the occurrence on *C. frutescens chrysaster*, near Berlin, of enlargements or outgrowths similar to those designated in America as crown gall, and supposedly due to infection with *Bacterium tumefaciens*.

Canker of oleander, P. HARIOT (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 1, pp. 38-40, fig. 1).—Briefly describing a disease of oleander, which is said to attack any organ thereof, causing enlargements which are described, the author mentions approvingly the views of Tonelli, who supposed the trouble to be of bacterial causation and to be favored as to transmission by the activity of insects (E. S. R., 29, p. 156).

A new fungus parasitic on Ceara rubber trees, F. VINCENS (*Bul. Soc. Path. Veg. France*, 3 (1916), No. 1, pp. 22-25, figs. 6).—A brief account is given of a disease of *Manihot glaziovii* observed in 1913 north of the bay of Rio Janeiro. The causal fungus, which is considered to be a new species, is described as *Haplographium manihoticola*.

Diseases of *Hevea brasiliensis* in the Amazon Valley.—I, Leaf diseases, II, Trunk diseases, F. VINCENS (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 1, pp. 11-27, 54-63, pls. 3, figs. 7).—Fungi noted in connection with diseases of

pathologies of *H. brasiliensis* include forms more or less reliably identified: *Dothidella ulmi*, *Fusicladium macrosporum*, *Phyllachora huberi*, *Apospharia Colletotrichum* (*Glucosporium*) *hevea*, *Pestalotzia palmarum*, and *Phyllosticta* sp., besides the supposedly new species *Scolecotrichum hevea*, *Fusarium* sp., *Zygosporium purpureum*, *Cercospora hevea*, and *Meliola hevea*, some of which are being compared with other forms.

Trunk and branch diseases mentioned in the second article as of considerable importance include those caused by *Fusicladium macrosporum* and *G. album*. Organisms of less importance are *Cephalosporium virens*, *Botryodiplodia theobromae*, a Corticium, and a Microthyrium.

Diseases of Hevea in Ceylon, T. PETCH (*Trans. 3. Internat. Cong. Trop. Med.*, vol. 1, pp. 596-607).—A preliminary abstract summarizing the principal points in this paper has been noted previously (E. S. R., 34, p. 849).

The effects of asphyxiating gases on forest vegetation, F. DÖR (Rev. Eaux et Forêts, 54 (1916), No. 7, pp. 192-195; abs. in Forestry Quart., 14 (1916), No. 748).—Giving a brief account of the results of gas attacks in the Chamouille in October, 1915, the author states that while grapevines, cruciferous crops, and deciduous forest trees were not seriously injured, ornamental trees were severely damaged. Conifers showed the injurious effects in a yellowing and shedding of leaves, recovery from which had become apparent, in some cases at least, by May 15, 1916.

The beech disease due to Nectria ditissima, M. GUINIER (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 2, pp. 91-92).—The author records, supposedly for the first time, a mode of attack by *N. ditissima*, in which the fungus starts on a young branch and kills the tissues for a certain distance, thus causing the death of the portion beyond.

Galls on juniper, P. HARIOT (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 1, pp. 8-10, fig. 1).—A description is given of a juniper gall associated with a fungus which is thought to be *Ceratostoma juniperinum*, hitherto unknown in France.

Peridermium strobil on Swiss pine, E. WERTH (*Mitt. K. Biol. Anst. Land u. Forstw.*, No. 16 (1916), pp. 14, 15).—A disease causing blister rust on Swiss pine was tested as to its ability to attack Ribes. Experiments proved successful in those cases in which the infected Ribes plant was kept under a bell glass. The fungus is therefore considered to be identical with *P. strobil*.

Dry rot, P. GROOM (*Jour. Bd. Agr. [London]*, 23 (1916), No. 5, pp. 465-474, fig. 12).—A brief discussion is given of *Merulius lacrymans*, *Coniophora orbicella*, and *Polyporus caperarius*, including conditions favorable to infection and development and measures for control of the dry rot fungi, which are said to cause immense losses annually in the United Kingdom.

ENTOMOLOGY.

The nature of the polyhedral bodies found in insects, R. W. GLASEB and W. CHAPMAN (*Biol. Bul. Marine Biol. Lab., Woods Hole*, 30 (1916), No. 5, pp. 367-399, pls. 3).—The authors' investigations of the nature of polyhedral bodies carried on in connection with the work previously noted (E. S. R., 33, p. 56) have been summarized as follows:

Polyhedral bodies are found in many different species of lepidopterous insects. The bodies are specific for a certain type of disease. The polyhedra vary in size in the different species. There exists a striking similarity in shape between the polyhedra found in different species. The polyhedra are structurally complicated. They arise in the nuclei of certain tissue cells. Cytomelic inclusions are found in certain diseases of higher animals. Nuclear in-

clusions have not been known previously. The polyhedra are nucleoproteid crystal-like degeneration products and not organisms. The polyhedra contain iron and phosphorus. On dissolving polyhedra in alkali and after dialyzing away the alkali and evaporating the protein solution crystals are obtained which simulate the original polyhedra."

A bibliography of 23 titles is included.

Some facts relative to the influence of atmospheric humidity on insect metabolism, T. J. HEADLEE (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 31-38).—The author's studies indicate that the speed of metabolism in the pupæ of both the bean weevil and the Angoumois grain moth varies inversely with the atmospheric humidity. In the adult of the former it varies with, while in the adult of the latter it varies inversely with, the humidity. In the egg stage the speed of metabolism varies inversely with the humidity, but in the larvæ and in the life cycle as a whole it varies with the humidity. It was found that reproduction of the bean weevil in tightly closed jars can be prevented by the introduction of sufficient concentrated sulphuric acid to keep the atmospheric humidity low.

Methods used in determining wind dispersion of the gipsy moth and some other insects, C. W. COLLINS (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 170-177, p/s. 2).—"Additional data [E. S. R., 33, p. 653] have been collected on long-distance wind dispersion of gipsy moth larvæ; namely, across Cape Cod Bay off the coast of Massachusetts. The direction of the wind, recorded at the time taken and previously, indicated the source of infestation to be from 19 to 30 miles distant on the mainland. Frequent examinations of the screens and close data kept on movements and direction of the winds were necessary to make these records of value.

"Screens used in the cranberry bog experiments and placed horizontally over the vines were well adapted to catch the drop of small larvæ floating over such areas, while the upright wire and cloth screens proved better for securing long distance spread.

"The recording of three extra lepidopterous species and possibly a fourth being carried by the wind in the larval stage suggests some possibilities for investigation with others along this line."

A method for the study of underground insects, J. W. MCCOLLOCH (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 183-188, fig. 1).—The author has found that the use of a 6-foot excavation in the ground, the sides of which are boarded up or cemented and a roof added, permits the rearing of subterranean insects at a fairly constant temperature. The fact that the daily range of temperature is small makes it possible to hold it at any desired degree for some time. The conditions in the cave have appeared to approximate those that would be encountered in the field by the subterranean forms studied.

Sixteenth report of the State entomologist of Connecticut for the year 1916, W. E. BRITTON (*Connecticut State Sta. Rpt. 1916, pt. 2, pp. VII+65-146 pls. 16, figs. 3*).—Following a report of nursery and apiary inspection, work with the gipsy and brown-tail moths is discussed. An account is next given of the turnip aphid (*Aphis pseudobrassicæ*) which was widely destructive during the year in Connecticut. Brief reference is made to the control of aphids in fields of seed beets in which it is stated that blackleaf 40 proved a satisfactory remedy. General accounts are given of the white-marked tussock moth and the rose chafer.

Experiments in controlling the striped cucumber beetle and the squash borer are briefly described by W. E. Britton and Q. S. Lowry (pp. 116-118). The striped beetle was more abundant than has ever been observed elsewhere and

and nearly all plants notwithstanding various treatments that were applied. The greatest benefit obtained in control measures with the squash borer was secured by the combined treatments of cutting out the borers and covering the soil with soil.

An outbreak of the eight-spotted forester (*Alypia octomaculata*) at New Haven in which grapes and the Virginia creeper were defoliated is reported by Q. S. Lowry (pp. 118-122), as previously noted (E. S. R., 37, p. 158). A rate of lead at the rate of 3 lbs. to 50 gal. of water was found to be very effective, one spraying being sufficient in most cases. The pine tip moth (*Phenax zimmermani*) was reared from material collected in several counties and recently occurs throughout the State. The parallel spittle insect on pine (*Protophthora parallela*), reported upon by B. H. Walden (pp. 125, 126), is said to have been quite abundant in the forest plantations at Rainbow during the two or three seasons. Antimosquito work in Connecticut during 1916 is reported upon by W. E. Britton and B. H. Walden (pp. 126-138). The entomological features of 1916 are briefly referred to.

The work concludes with accounts of miscellaneous insects of which mention may be made of a scale on azalea (*Eriococcus azaleæ*), the European elm borer (*Colpophora limosipennella*), another spruce gall aphid in Connecticut (*Chermes coolegi*) infesting the Colorado blue spruce at Hartford, injury by silverfish (*Thermobia domestica*), a scolytid beetle (*Xylloborus discolor*) which tunnels in the trunk of sugar maple, the walnut caterpillar (*Antona integerrima*) which was prevalent during the year, the tarnished plant miner injuring tobacco, the greenhouse leaf tyer (*Phlyctania ferrugalis*) which injured snapdragons, geranium, and cineraria at Norwalk in January, a flea beetle (*Edithia sezamulata*) found at Middlebury feeding on ash, white flies injuring California privet, the grapevine sawfly (*Erythraspidius pygmaeus*), *Euclemensia bassettella*, a microlepidopteran reared from a coccid gall to be *Kermes sassacii*, tegmids injuring shotgun cartridges, the boring of hardwood twigs by *Vespa crabro*, the hickory gall aphid (*Phylloxera ravalis*), and the grapevine tomato gall (*Lasiotera vitis*).

The nineteenth annual report of the State entomologist of Montana, R. A. Eyer (*Montana Sta. Bul. 112 (1916), pp. 53-76, fig. 1*).—The first part of the report consists of brief notes on the occurrence of the more important pests of 1916. This is followed by a review of the principal State interests in entomology in 1916, including the occurrence of and quarantine work with the alfalfa weevil, army cutworm, wheat sheath miner (*Cerodonta retalis*), sugar-beet root louse (*Pemphigus betæ*), lesser clover leaf weevil (*Stenomus nigrirostris*), spinose ear tick (*Ornithodoros megnini*), and foul brood of bees. Notes on the More Common Mosquitoes of Montana, by J. R. Eyer (pp. 69-75) follow.

Notes on several insects not heretofore recorded from New Jersey, H. B. Davis (*Jour. Econ. Ent., 10 (1917), No. 1, p. 224*).—The sawflies *Janus adductus* and *Diprion simile* are recorded as occurring at several points in New Jersey. The columbine leaf miner (*Phytomyza aquilegiae*) is a local pest of columbine at several points in the State, and a large roach (*Blaberus discolor*) has been found several times in greenhouses, having been introduced from South America.

Report of the entomologist, G. N. Wolcott (*Rpt. Bd. Comrs. Agr. P. R., 5 (1916), pp. 75-85, pl. 1*).—This is a brief summary of the activities of the entomologist, including inspection and quarantine work, citrus insect, tobacco insect, sugar-cane insect investigations. Analyses of sugar cane free from and infected by *Diatraea saccharalis* are included.

Report on tobacco and vegetable insects, R. T. COTTON (*Rpt. Bd. Comm. Agr. P. R.*, 5 (1915-16), pp. 86-99, figs. 3).—Particular attention was given to flea-beetles, of which four species, namely, *Epitrix cucumeris*, *Systema basalis*, *E. parvula*, and *E. fuscata*, attack tobacco, ranking in importance in the order named. The eggs of these beetles are deposited about the roots of the plants, upon which the larvæ feed, and the leaves are attacked by the adults.

E. cucumeris, unlike the other species of the genus, is present throughout the year and does a great deal of damage. Its eggs hatch in 5 days, the larvæ feed from 20 to 35 days, and 6 days are passed as a pupa. *E. parvula*, which is the third in importance, usually causes injury during dry spells. Its eggs hatch in 5 days and the larvæ feed for from 15 to 25 days, the pupal stage lasting for a period of 6 days. *E. fuscata*, which is occasionally found doing damage to tobacco, is very similar in its habits to *E. cucumeris*.

S. basalis, the largest of the flea-beetles that attack tobacco, is present in great numbers throughout the year. Its eggs hatch in 12 days, from 20 to 30 days are passed in the larval stage, and 9 days in the pupal stage. Preventive measures include the destruction of weeds and bushes that grow near tobacco fields. The seed beds and the young plants in the field should be kept dusted with a mixture consisting of 3 per cent Paris green and 97 per cent corn flour or leached wood ashes. Diplumbic arsenate of lead when used as a spray at the rate of 3 to 4 lbs. per 100 gal. of water also gives good results. When used as a dust it should be applied with at least an equal amount of dry wood ashes.

In reporting upon vegetable insects the author estimates that there is a 20 per cent annual loss due to their ravages. Two of the more abundant and destructive pests were studied, namely the chrysomelid beetles *Ceratomyxa ruficornis* and *Diabrotica graminea*. *C. ruficornis* feeds upon beans and cowpeas and when abundant strips the leaves to their veins and midribs. The damage is not confined to the beetles alone, for the larvæ which live in the soil around the roots of the beans, feed on the roots and nodules and make furrows in the subterranean portion of the stem. The eggs, which are laid in the soil upon the roots of the host plant, hatch in 8 days, the larvæ feed for a period of from 25 to 30 days before pupating, and from 5 to 8 days are passed in the pupal stage. The methods of control consist in the collection of the beetles as they first appear and spraying with a mixture of Bordeaux and arsenate of lead at the rate of 3 lbs. of the latter to 50 gal. of spray.

D. graminea is a source of injury to all kinds of truck crops, breeding as it does continuously throughout the year. The principal damage is done by the adult beetles, which feed on the foliage and flowers of the tender young plants; the larvæ feed on the roots of a number of plants, which they may seriously weaken. The eggs are deposited in the soil about the base of the plant and hatch in 8 days. The larvæ, which feed for a period averaging 22 days, generally attack the roots from the outside, but occasionally bore into the tissues of the plant at the crown. From 6 to 9 days are passed in the pupal state. The entire life cycle from egg to adult requires at least 36 days.

The sweet potato root borer (*Cylas formicarius*) has become a bad pest in Porto Rico only in the district near Fajardo known as "Las Cabezas," although present in small numbers in many parts of the island. The sweet potato scarabee (*Cryptorhynchus batatae*) has also done considerable damage to sweet potatoes in Porto Rico.

Experiments with plant lice and lace bugs on peppers, eggplant, and cucumbers showed that blackleaf 40 applied at the rate of 1 fluid ounce to 8 gal. of water plus 0.5 lb. of whale-oil soap gave perfect control. Arsenate of lead applied at the rate of 2.5 lbs. to 50 gal. of water gave excellent results in the control of the leaf-feeding larvæ of the moth *Xylomeges sunia* and the leaf-

ating beetles *C. ruficornis* and *D. graminca*. Further experiments with the 'changa' showed that almost perfect control may be obtained by surrounding the young plants when they are planted out in the field with a ring of the Paris green and flour mixture. This mixture consists of 3 per cent Paris green and 97 per cent of a flour high in gluten."

Important foreign insect pests collected on imported nursery stock in 1916, E. R. SASSER (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 219-223).—A summary of the more important results of Federal inspection work.

Some methods of colonizing imported parasites and determining their increase and spread, S. S. CROSSMAN (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 177-183, fig. 1).—The author describes the methods made use of at the Gipsy Moth Laboratory of the Bureau of Entomology of the U. S. Department of Agriculture.

Efficiency and economy in grasshopper control, E. D. BALL (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 135-139, fig. 1).—The author describes a grasshopper catching machine which is efficient, inexpensive, and when once built is always ready for immediate use. The details of its construction have been given in a bulletin previously noted (E. S. R., 33, p. 59). The machine takes 24 ft. at a sweep, and 40 acres can be covered in a day.

The seventeen-year locust in western New York, C. H. HADLEY, JR. and R. MATHESON (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 33-41).—The authors record the occurrence of this insect during the summer of 1916.

Biological and systematic notes on British Thysanoptera, C. B. WILLIAMS (*Entomologist*, 49 (1916), Nos. 641, pp. 221-227, fig. 1; 642, pp. 243-245; 643, pp. 275-284).—The author's studies have led to the conclusion that the American pear thrips (*Taniothrips pyri*) is no other than *T. inconsequens*, a species which has been known to occur in England for nearly 100 years, and which does not usually cause much injury in Europe. The author considers it practically certain that the species was introduced into California from Europe in the larval or pupal stage in the soil attached to the roots of fruit trees. Its spread from there to other parts of the United States, and recently into Canada, may have been by the same means, or by the rapid transference of adults by railway trains, etc., or it is possible that a fresh introduction from Europe might have occurred. Its distribution as now known includes Bohemia, Italy, England, the United States, and Canada.

In further notes on the pea thrips *Kakothrips pisivora* (E. S. R., 34, p. 450), it is stated that during 1915 the damage which it caused was more severe than ever before noticed. "By June 25 first and second stage larvæ were abundant in all the flowers and on the pods, and by July 5, when nearly all the larvæ were large, over 60 per cent of all the pods were more or less severely damaged by them. In nearly all cases the pods nearest the base of the plants, that is the earlier ones, were almost undamaged, while those near the top were so severely attacked that in many cases the flower dried up without setting any pod, while those pods which did start were small, deformed, and contained no seed at all.

"Most of the larvæ were feeding quite openly on the pods, only a few being hidden by the remains of the flower, and specimens examined during the night were found to be as active then as during the daytime. At this stage it would be possible to kill a large percentage by spraying. On July 7 there was an extremely heavy, almost tropical rainstorm, yet immediately after it quite a large number of larvæ were still feeding openly on the pods, chiefly on the lower surfaces. In the first fortnight in July nearly all the larvæ descended, but a few fed ones were found on till the end of July."

Notes on its natural enemies and host plants are included.

Four new species representing the genera *Sericothrips*, *Heliethrips*, *Thrips*, and *Haplothrips* are described.

The green soldier bug (*Nezara hilaris*), R. D. WHITMABSH (*Ohio Sta. Bul. 310* (1917), pp. 519-552, figs. 16).—This is a detailed report of studies of *N. hilaris*, which is recorded for the first time as causing serious damage in the Northern States, although previously reported as a pest of peaches in Georgia and of oranges in Florida. It was first noticed as a serious pest of peaches in the Northern States in 1911, when it did considerable damage along the shores of Lake Erie, especially in the vicinity of Gypsum and Port Clinton, Ohio. Attention is called to the fact that it is widely distributed in the northeastern United States and Canada, where it is quite a general feeder.

There is but one brood, the greater part of the year including the winter months being passed in the adult stage. In Ohio the eggs commence to hatch the second week in June, from which time the several stages appear until about the middle of October, when the greater part become adult. The nymphs hatch out in about 7 days, and from 49 to 75 days are required for the young to pass through the five instars before becoming adult. The young nymphs of the first instar are gregarious in their habits, but upon molting the first time lose this tendency, separating in all directions in search of food.

Fruit when badly punctured by these insects is entirely unsalable, while fruit showing but slight injury must be placed in a lower grade. It is entirely possible that one bug from the time of hatching until harvest is capable of injuring several bushels of fruit. In badly infested orchards it was not uncommon to note an average loss of at least 3 bu. per tree. Besides the actual loss one must take into consideration the amount of extra labor involved in sorting the damaged fruit.

While a prototrypid egg parasite, probably *Trissolcus euschisti*, is of considerable importance in checking the green soldier bug, weather conditions are a dominating factor in suppressing it.

Mercurial ointment, an effective control of hen lice, G. H. LAMSON, JR. (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 71-74).—Substantially noted from another source (*E. S. R.*, 35, p. 183).

Distribution of the Ohio broods of periodical cicada with reference to soil, H. A. GOSSARD (*Ohio Sta. Bul. 311* (1917), pp. 555-577, figs. 15).—This is a report of studies which have led the author to conclude that a definite relation exists between the distribution of the cicada broods in Ohio and the soil areas in which they occur. The subject is taken up under the headings of comparative description of soils, possible ecological factors, theories of brood formation, etc.

Aphid eggs in Texas (Lat. 30° 30'), H. C. YINGLING (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 223, 224).—The author records the deposition of eggs in Texas in December on a dogwood stem (*Cornus asperifolia*) by what is thought to be *Schizoneura corni*.

A new tree banding material for the control of the gipsy moth, A. F. BURGESS and E. L. GRIFFIN (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 131-135, pls. 2).—Following tests of Raupenleim applied by means of a gun manufactured for such use, the Bureau of Entomology has conducted investigations in cooperation with the Bureau of Chemistry of the U. S. Department of Agriculture which have led to the preparation of a quite satisfactory banding material. This consists of a high boiling neutral coal-tar oil having a density of about 1.15 at 29° C., a soft coal-tar pitch, rosin oil of the grade known as first-run "Kidney" oil, and ordinary commercial quicklime, directions for the preparation of which are given. This material is considerably cheaper than any successful banding material now on the market.

"Pound for pound the tree-banding material will cover about two-thirds as many lineal feet as tree tanglefoot, but as the trees do not have to be scraped before applying the former band, the labor is reduced, so that a large saving is made by using this material. The bands remain on the trees during the winter and can be moistened with turpentine in the spring so that they will be effective for two seasons."

The present status of the gipsy and brown-tail moths in Connecticut, J. W. DAVIS (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 193-195).—A brief review of the present status of these pests in Connecticut.

Crambid moths and light, G. G. AINSLIE (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 114-123, figs. 2).—This study is based upon collections made at light at Nashville, Tenn., during the summer of 1915. At least 14 species of Crambinae were found to occur at that place, although the greater bulk of the material consisted of *Crambus teterellus*, a very common and widely distributed species on which the data presented are based and to which the conclusions drawn directly apply. The author has been unable to determine what meteorological condition determines their attraction to light, but finds that it does not depend on temperature.

The studies have led to the conclusion that, so far at least as this species is concerned and very probably with all crambids, neither trap lights nor poisoned baits can be used successfully under normal conditions to reduce the number of these very common and secretly injurious insects.

"Side injury" and codling moth control, E. P. FELT (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 69-66).—The term "side injury" is limited in this paper to the characteristic bluish produced by late-hatching codling moth larvæ entering the smooth side of the apple, running just under the skin a circular gallery with a radius of about $\frac{1}{8}$ in. and then in a few days deserting this initial point of injury and usually migrating to the blossom end. This bluish, which is frequently marked by a red or reddish-brown discoloration, was the cause of serious loss in western New York in 1915, as high as 20 per cent of such injury often being found in sprayed orchards. The experimental work of 1916, here reported upon, is in continuation of that of 1915, previously noted (E. S. R., 34, p. 855).

The variation in the percentage of wormy apples appears to be affected more by the size of the crop than the number of sprayings, and there is a fairly constant ratio between the total wormy fruit and the apples showing side injury. "Generally speaking, the development of side injury is conditioned upon the deposition of numerous eggs after the apples have become an inch or so in diameter and smooth enough so as not to repel the parent moth. We are satisfied that by far the greater benefit comes from the spraying just after blossoming, and that the side injury is in general proportional to the infestation of the orchard."

Recent antimosquito work in Connecticut, W. E. EMERTON (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 199-111).—A brief statement of the work carried on in Connecticut. See also the work noted on page 255.

The influence of salinity on the development of certain species of mosquito larvæ and its bearing on the problem of the distribution of species, F. E. CHIDESTER (*New Jersey Stat. Bul.* 299 [1916], pp. 3-16, figs. 6).—From field records and laboratory experiments it is concluded that the distribution of the two dominant species of the salt-marsh mosquitoes in New Jersey is in part dependent on the salinity of the water. The fresher waters seem to bring out the brown salt-marsh mosquito (*Aedes cantator*), while the marsh pools with slightly higher salinity seem to be more favorable for the development of *A. sollicitans*.

Aside from its value as a means of bringing fish to the pools and providing means of quickly draining some areas, ditching is of importance in bringing salt water to increase the salinity of permanent pools, thus rendering them salt enough in some cases to retard and in some cases to check completely the development of the mosquitoes. It is suggested that there is a possibility that the incoming tide may drown the mosquito larvae by the rise and fall of its waves as they advance.

See also a previous note (E. S. R., 36, p. 255).

A biological study of the more important of the fish enemies of the salt-marsh mosquitoes, F. E. CHIDESTER (*New Jersey Stat. Bul.* 300 (1916), pp. 3-16, pl. 1, fig. 2).—This is a report of studies commenced September 19, 1914, and carried on for more than a year.

The barred killifish (*Fundulus heteroclitus*) was found to be the greatest natural enemy of the salt-marsh mosquito and also to eat many green-head flies. "*F. heteroclitus* captures larvae, pupae, and adults of the mosquito, eating as many as 50 a day and killing many more. The vast hordes of fishes which migrate to the shallows and even into almost fresh water render the species especially formidable. The number of enemies of the mosquito which are eaten by *F. heteroclitus* is negligible and is more than compensated for by the great preponderance of mosquitoes in the diet of the fish. The ease with which *Fundulus* may be artificially fertilized and the remarkable vigor and resistance of the young embryos make the stocking of pools and streams with this species a simple matter."

A list of 19 references to the literature relating to the subject is appended.

Results of ten years of experimental wheat sowing to escape the Hessian fly, G. A. DEAN (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 146-162, fig. 1).—This is a summary of work conducted at the Kansas Experiment Station, much of which is presented in tabular form. In that State the most important steps in the control of the Hessian fly are (1) early, deep plowing of the stubble, (2) proper preparation of the seed bed, (3) destruction of all volunteer wheat, (4) delay in sowing until the fly-free date, and (5) cooperation.

Wind as a factor in the dispersion of the Hessian fly, J. W. MCCOLLOCH (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 162-170, fig. 1).—This deals with observations made at the Kansas Experiment Station which show that wind is an important factor in the distribution of the Hessian fly. At the places where many of the observations were made the flies were being carried up over the hills and into the wheat fields lying on the other side in the Blue River Valley. The fact that the flies were uninjured on reaching the screens would indicate that they could be carried much greater distances. The relatively large number of flies caught on the small screen area at 2 miles is indicative of the possible magnitude of their flights.

This work shows that cooperation must be practiced over large areas and that the individual grower can not be promised immunity from injury even if he does prepare a good seed bed and plants late. All stubble fields and volunteer wheat fields must be plowed under early in the fall, as they are the greatest sources of infestation.

The protection of dairy cattle from flies, E. N. CORY (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 111-114).—Several complaints that butter made at the Maryland Experiment Station was very perceptibly tainted with the coal-tar odor where proprietary coal-tar products had been used in protecting cattle from flies led to the preparation of a pine-tar creosote emulsion which left no such taint. This was made by dissolving $\frac{3}{4}$ lb. of caustic soda, 98 per cent pure, in a known quantity of water for every gallon of pine-tar creosote, and then diluting with cold water to the desired strength.

In tests made of 1 to 5 per cent emulsions it was found that the 3 and 5 per cent emulsions killed all flies that were thoroughly wetted. The 3 per cent emulsion was the most effective minimum strength, its protection being fully effective for one day, and there was considerable protection afforded for two and even three days. The cost of spraying was less than 0.5 ct. per cow per application.

The radish maggot and screening. P. J. PARROTT (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 79-81).—Experiments carried on at the New York State Station for the past three years show that, as with the seedlings of late cabbage (E. S. R., 35, p. 855), satisfactory results may be obtained from screening beds for the protection of radishes. Cheesecloth when properly attached affords complete protection from root maggots and according to the fineness of the mesh reduces to a more or less extent injuries by the flea-beetle, both of which pests when abundant may destroy as well as retard growth.

A chemical feeding analysis of white grubs and May beetles (*Larhno-sterina*) and its economic application. J. J. DAVIS (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 41-44).—The advantages of pasturing hogs on grub-infested land are summarized as "eradication of grubs which might otherwise destroy the crops planted on the ground; value of the grubs as hog feed, which is comparable with feeds costing \$25 to \$35 per ton; and value of the manure distributed over the land, which has a money value, according to the experts of the Federal Bureau of Animal Industry, of \$3.29 per ton."

The spinach carrion beetle (*Silpha bituberosa*). R. A. COOLEY (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 94-102, pl. 1).—This little-known pest has at times been very abundant and injurious to sugar beets in the Yellowstone Valley of Montana.

The injuries by both the larvæ and adults take place mainly early in May, while the plants are still very small and before the work of blocking and thinning has been done. In Montana it is a source of injury to the sugar beet only, but has been reported by Fletcher (E. S. R., 10, p. 866) as also injuring spinach, squash, pumpkin, etc. Both adults and larvæ have been found to feed upon *Monolepis nuttalliana* and *Solanum triflorum*, and the adults only on alfalfa. It occurs from northern Kansas northward to Alberta and Saskatchewan, but does not appear west of the main divide of the Rocky Mountains except in the State of Idaho.

At Bozeman, Mont., there is but one brood per year, and the winter is passed by the adults buried in the soil. The eggs are laid, preferably in moist soil, as deep as 2 in., oviposition occurring as early as March 15 and the number laid by an individual in confinement running as high as 75, with an average of 30. The incubation period was found to vary from 3 to 6, with an average of 4.55 days, and the larval period from 20 to 33 days. The larvæ prefer to feed during the night and remain in hiding in the soil during the day. Both the adults and larvæ feed from the edges of the leaves and injured plants present a characteristic appearance. When full grown the larvæ burrow into the soil to a depth of from 1 to 2 in. and construct an oval cell in which to pupate. The period in the soil is about 25 days and the pupal period about 18 days.

In control work, poisoned-bran mash, prepared by the usual formula, scattered among the weeds near the beet fields where the insects were present in great numbers resulted in nearly complete destruction of them.

The striped cucumber beetle. H. A. GOSSARD (*Mc. Bul. Ohio Sta.*, 2 (1917), No. 4, pp. 117-120, fig. 1).—A popular summary of information on this pest.

Egg-laying habits of *Diprion simile*. M. P. ZAPPE (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 188-190).—The author reports upon oviposition observations

of this European sawfly, which was first discovered in Connecticut in August 1914, as previously noted (E. S. R., 35, p. 53).

In captivity eggs were laid on five species of five-needle pines, on six species of two-needle pines, and on one species of three-needle pines. As many as 125 eggs are deposited by a single female, usually being placed in needles of the previous year's growth, if any are present.

Notes on the bean weevil (*Acanthoscelides* [*Bruchus*] *obtectus*), J. A. MANIER (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 190-193).—A summarized account of the biology of this pest and means for its control.

The alfalfa weevil investigation, G. I. REEVES (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 123-131).—In reporting upon the results of investigations of the alfalfa weevil by the Bureau of Entomology of the U. S. Department of Agriculture, it is stated that five practical control measures have been developed, namely, flooding with sediment, spraying with arsenical poisons, pasturing, harrowing the stubble, and colonizing with parasites. While none of these measures is entirely perfected and not all are equally valuable, they are all useful and all are in actual use.

The clover weevil in Iowa, R. L. WEBSTER (*Jour. Econ. Ent.*, 10 (1917), No. 1, p. 225).—Records indicate that the clover weevil (*Hypera punctata*) occurs all through southern Iowa and probably most of eastern Iowa.

The plum curculio, W. H. GOODWIN (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 4, pp. 113-116, figs. 4).—A brief summary of information relating to the curculio. It is stated that during the last three seasons arsenate of lead paste at the rate of 2 to 3 lbs., with 2:3:50 Bordeaux and 2 lbs. of soft soap, was used successfully under the author's direction for preventing the injuries caused by the curculio, with no injury to the fruit or foliage.

Lime as an insecticide, Z. P. METCALF (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 74-78, pls. 2).—This paper relates to work at the North Carolina Experiment Station with the bean weevil and cowpea weevil in cowpeas being saved for seed.

Cowpeas were treated late in September, 1913, and left until the following spring, when they were examined. Those treated with air-slaked lime at the rate of one part to four parts of peas gave a germination of 71 per cent; those with air-slaked lime, one part to eight parts of peas, gave a germination of 48 per cent; those with crude carbolic acid at the rate of one-half and one pint per bushel gave 21 per cent germination; those with kerosene at the rate of one-half and one pint per bushel, 21.5 per cent germination; and those with carbon bisulphid, at from 15 to 30 lbs. to 1,000 cu. ft. of space, 17.5 per cent germination.

The favorable results obtained with air-slaked lime resulted in the further experiments, here reported. These have led to the recommendation that cowpeas be stored in air-slaked lime at the rate of one part lime to two parts peas by weight, at least until something cheaper and more effective can be devised for the average farmer.

In a discussion of this paper which follows, W. E. HINDS states that in a series of experiments at the Alabama College Station in which several varieties of dry cowpeas were submerged in liquid carbon bisulphid for periods ranging approximately from one minute to 1,000 hours, absolutely perfect germination resulted in all cases. Tests made have shown the reported differences in germination to be due to the varying percentage of moisture at the time of the experiment.

Problems of bee inspection, F. C. PELLETT (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 260-263).—A discussion of the problems that must be solved by the bee inspector.

The results of apiary inspection, E. F. PHILLIPS (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 204-210).—A discussion of results obtained from the inspection of apiaries since the first inspection law was passed by Wisconsin in 1897.

Some new and practical methods for the control of European foul brood, L. G. CARR (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 197-200).—A strong colony, cessation of brood rearing in the diseased combs for a time, and good Italian stock are the three principles involved in the treatment of European foul brood without destroying the combs.

Report on *Isosoma* investigations, W. J. PHILLIPS (*Jour. Econ. Ent.*, 10 (1917), No. 1, pp. 139-146, pls. 2).—This is a review of the present status of *Isosoma* work as conducted by the Cereal and Forage Insect Investigations Division of the Bureau of Entomology of the U. S. Department of Agriculture.

It is stated that the injury caused by *Isosoma vaginicolum*, described by Deane in a paper previously noted (*E. S. R.*, 36, p. 59), agrees entirely with that noted in the Eastern States, and apparently is due to the same species. Up to the present time no species has been induced to breed on any other plant than its own particular host. One of the most promising measures in the control of *I. tritici* at present in some of the Eastern States is to plow under wheat stubble as soon after harvest as is possible, prepare a fine seed bed, and sow the clover and grass in August or September instead of seeding in the wheat in the spring.

FOODS—HUMAN NUTRITION.

Biology and the nation's food, W. J. SPILLMAN (*Sci. Mo.*, 4 (1917), No. 3, pp. 220-225).—In this paper the author discusses certain biological problems, such as increasing the acre yield of crops and increasing the production of livestock, in their relation to the future food supply.

Bread of the future and measures taken for its utilization, SCHIRBAUX (*Compt. Rend. Acad. Agr. France*, 3 (1917), No. 14, pp. 407-409).—Data are reported regarding the use of barley, buckwheat, and corn in supplementing the wheat supply.

It has been found possible to make a satisfactory bread by mixing 80 per cent of wheat flour and 20 per cent of barley flour. On the contrary, the mixture of buckwheat flour with that of wheat makes a dough of poor consistency on account of the decreased quantity of gluten, and fermentation is slow and irregular. The baking in this case must be done at a lower temperature than when wheat alone is used, if a hard, crusty bread is to be avoided. The proportion of barley used may be as high as 30 per cent, but not more than 20 per cent of buckwheat can be used with good results.

On the rations of bread in the army (*Compt. Rend. Acad. Agr. France*, 3 (1917), No. 12, pp. 352, 353).—It is maintained that there is a large amount of waste in the bread supply of the French Army. This is due to the soiling of the bread in transportation and handling and to the fact that the hard-baked bread or biscuit is often wasted by soldiers who have bad teeth.

Some common edible and poisonous mushrooms, FLORA W. PATTERSON and FRED K. CHARLES (*U. S. Dept. Agr., Farmers' Bul.* 796 (1917), pp. 24, figs. 23).—This contains information regarding the structure of mushrooms and gives descriptions of different mushrooms and miscellaneous fungi. Precautionary measures in the selection of mushrooms for food and recipes for the canning and drying of mushrooms and their preparation for the table are included.

Concerning copper in tomatoes, P. CARLES (*Rev. Sci. [Paris]*, 55 (1917), n. 6, p. 153).—According to the author, copper has been found in fresh tomatoes and in other fresh vegetables, but not in sufficient quantity to endanger health.

Food economics at agricultural school, Minnesota University (*Hotel Mg.* 25 (1917), No. 290, pp. 40-45, *Aggs.* 5).—It is stated that this institution is able to serve abundant, well-planned meals to its students at a cost of 21 cents per person per day for food materials. This is made possible by careful planning by purchasing in quantity when prices are low, and by the use of specially planned cold-storage houses, detailed plans of which are given. Fruits and vegetables are put up in their season for winter use and bread is made from cleaned whole-wheat berries which have been ground in the coffee mill at the school. Only good cream or butter is used on the table. The cost quoted was for January, 1917.

Food [of the Labrador Eskimo], E. W. HAWKES (*Canada Dept. Mines, Geol. Survey Mem.* 91 (1916), pp. 29-36).—This article gives an account of the food habits of the people and describes the methods of preparation of the foods. The diet consists largely of game (seal, walrus, whale, and reindeer), fish, eggs of wild birds, herbs, and berries.

The food supply of the United Kingdom (*Jour. Bd. Agr. [London]*, 21 (1917), No. 11, pp. 1046-1052).—This is a brief report of a survey made by a committee of the Royal Society appointed by the Board of Trade to study the food supply of the United Kingdom. It contains data regarding the food supply before the war, the food supply in 1916, and possible methods of economizing the available food supply.

Great Britain's measures for control of food, P. C. WILLIAMS (*U. S. Dept. Com., Com. Rpts.*, No. 101 (1917), pp. 407-410).—A brief review of the efforts of the British Government to insure the conservation, economical distribution, and increased production of foodstuffs.

The growth of rats upon diets of isolated food substances, T. B. OSBORNE and L. B. MENDEL (*Biochem. Jour.*, 10 (1916), No. 4, pp. 534-538).—In this paper the authors call attention to the fact that in an article by McCollum (*E. S. R.*, 35, p. 472) the facts reported were essentially in harmony with their own experience in the study of the growth of white rats fed upon mixtures of isolated food substances. The results of their experiments upon certain phases of the problem are reviewed and discussed in their relation to the results of other investigators in order to make clear that their own views are not at variance with those of some other investigators in this field at the present time.

The supplementary dietary relationship between leaf and seed as contrasted with combinations of seed with seed, E. V. MCCOLLUM, N. SIMMONS, and W. PITZ (*Jour. Biol. Chem.*, 30 (1917), No. 1, pp. 13-32, *Aggs.* 14).—Earlier work of the authors has demonstrated the close resemblance of wheat, maize, and oat kernels in their dietary properties, namely, the relatively poor quality of the proteins, poor content and composition of the inorganic portion of each seed, and the inadequate supply of fat-soluble A.

The present paper presents further data regarding the lines on which successful nutrition is to be attained when the diet is derived solely from vegetable sources, the discussion being limited to the results obtained with combinations of seeds from several sources and of seeds with the alfalfa leaf. Feeding experiments have shown that the nutritive requirements for rats and swine are essentially the same and that neither species can grow satisfactorily when restricted to one of the cereal grains, although both respond in much the same way with growth and reproduction to specific modifications of the diet when restricted as to source.

The authors have been unable to make up a ration derived solely from the seeds of plants which would support normal nutrition through the growing period even though from 2 to 5 seeds of widely different varieties were employed. However, results of a very different character were secured when

the combinations of leaf and seed were fed as monotonous diets. It has been found that with wheat, oats, and maize in equal proportions both salts fat-soluble A must be added to the ration before growth can take place, that "it is difficult if not impossible to obtain even a moderate amount of growth over an extended period on a diet restricted to the seeds of plants." Satisfactory protein mixtures can be had from seed mixtures, and experiments have shown also that certain seeds, such as flaxseed and millet, contain the fat-soluble A in fairly liberal amounts. "Since the water-soluble B is everywhere abundant in the seeds the cause of failure to secure growth on mixtures is seen to lie in the amount and character of the inorganic matter. . . . Of the seven most important seeds from the standpoint of human nutrition and animal production only cotton seed and flaxseed contain a high inorganic content, and in both cases the ash is very poor in three important elements, sodium, calcium, and chlorine. Since a pronounced deficiency of these elements is characteristic of all other seeds as well, no combinations of seeds will supply these elements in satisfactory amounts."

If necessary inorganic supplements may be secured in some localities through the drinking water, which would enable the animals in those localities to grow on a ration restricted to seeds.

The leaf is distinctly different from the seed in its dietary properties in several respects: Its total inorganic content is very high, and it is especially rich in sodium and calcium, both of which are deficient in the seeds generally. In addition the leaf of the plant is several times richer in fat-soluble A than the wheat, oat, and maize kernels. Certain seeds approximate the value of the leaf in this substance. Hempseed is distinctly better than those just mentioned, but flaxseed and millet seed are still richer than hempseed and may easily be incorporated in the diet in amount sufficient to meet the needs of animals for the fat-soluble A during growth."

In feeding experiments with deficiencies in the amino-acid supply: **Arginine** and **histidine** as possible precursors of purins, H. ACKROYD and F. G. HOPKINS *Biochem. Jour.*, 10 (1916), No. 4, pp. 551-576, figs. 6).—This paper reports the results of a large number of experiments with laboratory animals (rats). The data obtained may be summarized briefly as follows:

Removal of arginine and histidine from the diet of rats which had been previously growing on a complete amino-acid mixture resulted in a rapid loss of body weight. Restoration of the missing diamino acids to the diet resulted in renewed growth.

Restoration of arginine alone or histidine alone resulted in no loss of weight in some cases in growth. Nutritional equilibrium was possible in the absence of one of these related protein constituents, although not in the absence of both. A reason suggested for this is that each one of them can in metabolism be converted into the other. When arginine and histidine were both removed from the food the amount of allantoin in the urine was much decreased, but when they were replaced the excretion returned to normal. The decrease was much less when either one of these diamino acids was present alone.

When tryptophan was removed from the food no decrease of allantoin occurred, although nutritional failure was even greater than when arginine and histidine were withheld. No decrease of allantoin excretion was observed when animals were losing weight as the result of the absence of vitamins from diet.

In view of these results the authors suggest that arginine and histidine play a special part in purin metabolism, probably constituting the most readily available raw material for the synthesis of the purin ring in the animal body.

The influence of heavy metals on the isolated intestine, W. SALANT and C. W. MITCHELL (*Amer. Jour. Physiol.*, 39 (1916), No. 4, pp. 355-374, figs. 14).

The respiratory process in muscle and the nature of muscular motion, W. M. FLETCHER and F. G. HOPKINS (*Proc. Roy. Soc. [London]*, Ser. B, 19 (1917), No. II 619, pp. 444-467, figs. 8).—This lecture deals with the law of molecular oxygen and the theory of "Inogen," the effects of oxygen upon muscular lactic acid in muscle, and the heat production of muscle. From a consideration of all the data presented, the authors bring out the fact that the actual chemical changes which underlie the contraction, fatigue, and recovery of muscle are relatively simple and that the chemical changes themselves are not complex or obscure, the complexity being found only in the conditions under which they occur. A bibliography is appended.

Clinical calorimetry, XIX-XXV (*Arch. Int. Med.*, 19 (1917), No. 5, pp. 823-957).—Seven articles are presented.

XIX. *The basal metabolism of old men*, by J. C. AUB and E. F. DuBois (pp. 823-831, figs. 2).—The subjects of these experiments were from 77 to 83 years old and were in good health, considering their ages. The average basal heat production, as determined by calorimeter experiments, was found to be 30 calories per square meter of body surface per hour, which is 12 per cent below the average for men between the ages of 20 and 50. The results obtained by direct and indirect calorimetry agreed closely and the respiratory quotients were all within normal limits.

XX. *The effect of caffeine on the heat production*, by J. H. MEANS, J. C. AUB, E. F. DuBois, and G. F. Soderstrom (pp. 832-839, fig. 1).—The authors review the literature regarding the effect of caffeine on metabolism and report the results of calorimeter experiments on four normal men. After a preliminary period and one or two hours' observation of the subjects' normal basal metabolism, the caffeine was ingested in the form of the pure alkaloid dissolved in pure water. Studies were made of the basal metabolism after the ingestion of caffeine, of the respiratory quotient, of the elimination of water from the skin and lungs, of the elimination of nitrogen, and of the pulse rate. The results of the investigation are summarized as follows:

"An increase of from 7 to 23 per cent in the basal metabolism was found in four normal subjects after receiving from 8 to 10 grains of caffeine alkaloid (8.6 mg. per kilogram of body weight). After taking the drug there was no significant change in the pulse rate, in the respiratory quotient, in the proportions of the various foodstuffs metabolized, or in the percentage of heat lost in the vaporization of water. The independent methods of direct and indirect calorimetry gave results which agreed within 1 per cent."

XXI. *The basal metabolism of dwarfs and legless men with observations on the specific dynamic action of protein*, by J. C. AUB, E. F. DuBois, and G. F. Soderstrom (pp. 840-864, figs. 8).—This paper reports the results of calorimetric observations upon five dwarfs, two legless men, and six normal (male) controls. The results are summarized as follows:

"The legless men and the dwarfs with apparently normal endocrine systems showed, in relation to their surface area, the same level of metabolism as normal men. The law of surface area holds good for men of unusual body shape.

"The dwarfs with involvement of the ductless glands and symptoms of cretinism showed a marked reduction in metabolism below the average found in normal cases, as has been reported by other authorities.

"Following the ingestion of large quantities of meat, the excretion of urinary nitrogen during the earlier hours is not an accurate index of the protein metabolism. The sulphur excretion is more rapid than the nitrogen excretion.

The stimulation of metabolism following a large amount of meat is almost at its height two hours after the meal is eaten. The extra heat produced may amount to three-quarters of the calories in the protein metabolized, and may amount to an increase of 46 per cent above the level of the basal heat production. The specific dynamic action of a meal containing 24 gm. of nitrogen in the form of meat was larger in the case of a legless man and of an achondroplastic man with very small arms and legs and normal trunk than in the cases of normal controls of greater weight and greater surface area. This indicates that the intensity of the specific dynamic action is not proportional to the mass of the musculature. The true explanation of the results can not be given in the light of present knowledge. Various possible explanations come readily to mind, such, for example, as a greater concentration of amino acids in the blood flowing to the muscles, or the presence of a liver, which, in proportion to the size of the organism, is relatively larger than the normal."

(II). *The respiratory metabolism in nephritis*, by J. C. Aub, E. F. Du Bois, and G. F. Soderstrom (pp. 865-889).—This paper reports the results of studies, with a respiration calorimeter, of 10 individuals suffering from nephritis. The following are quotations from the author's summary:

"In most of the patients with greatly increased blood pressure the metabolism was higher than in the other nephritics with lower blood pressures. Most of the patients with marked dyspnea showed some increase in metabolism. . . .

"The respiratory quotients are all within normal limits, showing that these patients derive their energy from very much the same proportions of the various foodstuffs as do normal men. . . .

"The normal quotients found in patients with low carbon dioxide combining capacity of the plasma prove that nephritic acidosis is not caused by difficulty in oxidizing carbohydrates."

(III). *The effect of Roentgen-ray and radium therapy on the metabolism of a patient with lymphatic leukemia*, by J. B. Murphy, J. H. Means, and J. C. Aub (pp. 990-997, figs. 3).

(IV). *Metabolism in three unusual cases of diabetes*, by F. C. Gephart, J. C. Aub, E. F. Du Bois, G. Lusk, and G. F. Soderstrom (pp. 998-1030).

(V). *The water elimination through skin and respiratory passages in health and disease*, by G. F. Soderstrom and E. F. Du Bois (pp. 931-957). As a result of these experiments the authors state that the technique of determining the water eliminated from the skin and respiratory passages of the subject in a respiration chamber is exceedingly difficult for the following reasons: Moisture may be deposited on the contents of the chamber if the humidity of the air in the chamber rises, and water will be removed which was not eliminated by the subject in the experimental period if the relative humidity of the air in the chamber falls. Over 300 experiments were made with the Sage calorimeter at a room temperature of 22 to 25° C. and a relative humidity between 30 and 50 per cent. For purposes of comparison, all experiments were excluded in which the relative humidity changed more than 10 per cent during the observation period. A table is given showing the water vaporization of different groups of subjects studied under different conditions of growth, temperature, and ventilation.

Normal men 20 to 50 years old under the standard conditions excrete on an average 23 gm. water an hour (about 700 gm. a day) through skin and air passages, losing in this manner 24 per cent of the total heat produced. Few normal men depart more than one-tenth from this figure. All the results on patients are compared with this standard figure of 24 per cent. Boys 12 to 13 years old give figures close to the upper limit and very young men lose almost the same percentage of calories in vaporization. **Dwarfs**

and legless men are also close to the normal average. Cretinoid dwarfs show diminished water elimination. Typhoid patients with a rising temperature also have a decreased water output; those with a falling temperature lose an increased percentage of calories in vaporization. The water output in convalescence is low.

"Some patients with hyperthyroidism have a decreased water output; most of them lose the normal percentage of calories in vaporization. Some lose much more than normals in this manner. In pernicious anemia the water of vaporization is not affected. Cardiac and nephritic patients on the whole give figures close to the normal. There is a slight increase in dyspneic patients. Edema seems to have no effect on the water output through the skin. The results in diabetes show great variations. The average figure, however, is about the same as that obtained in normals.

"In conclusion it may be said that the output of water is very little affected in disease. When the heat production is increased the body responds and dissipates the usual percentage of calories in the vaporization of water. When it is necessary to get rid of unusual amounts of heat the percentage lost in vaporization is increased."

ANIMAL PRODUCTION.

Commercial feeding stuffs, J. P. STREET ET AL. (*Connecticut State Sta. Rpt. 1916, pt. 3, pp. 147-184*).—This is a report of the State feed inspection, including analyses of cottonseed meal, linseed meal, wheat bran, wheat middlings, red dog flour, rye middlings, buckwheat middlings, corn gluten meal, corn gluten feed, hominy feed, dried brewers' grains, malt sprouts, dried distillers' grains, dried beet pulp, meat scrap, tankage, bone, coconut meal, salvage wheat, cracked corn, alfalfa meal, beans, bread crumbs, and mixed, proprietary, and poultry feeds.

[Animal husbandry work at the Crookston substation] (*Minnesota Sta. Rpt. Crookston Substa., 1910-1916, pp. 83-87*).—In an experiment during the winter of 1913-14 beef cattle were maintained in prime condition in a straw shed. In this test dry shock corn was equal to corn silage as a supplement to millet and timothy hay and ground oats and barley. There was some waste from unconsumed cornstalks, whereas all the silage was eaten. Difficulty was experienced in feeding silage out of doors in cold weather.

In a test during the winter of 1913-14 it was found that sheep did not relish warm water.

Ground flaxseed was compared with tankage as a protein supplement to barley, corn, and oats for pigs. The tankage proved distinctly superior to the flaxseed, and the results indicated that the latter is not a practical feed for swine.

Wet-mash feeding was compared with dry-mash feeding for laying hens in the winter of 1913-14. The wet-mash lot laid slightly more eggs at a smaller cost per dozen than the dry-mash lot. In later years, however, the dry-mash method gave better results at a less labor expenditure than the other method. Wet mash proved superior to dry mash for young chicks, especially during the first week of the chick's life. In a fattening test with three-months-old cockerels Barred Plymouth Rock cockerels gained 2 lbs. each in three weeks as compared with 1.16 lbs. for Leghorn cockerels.

The results of egg preservation experiments in 1913 showed that a solution of sodium silicate and water (1:5) is unnecessarily strong, a dilution of 1:10 giving the best results. Eggs stored in limewater (1 lb. of lime to 5 gal. of water) kept in excellent condition, except that the bottom layer of eggs had

light flavor of lime. Similar results were secured in tests in 1915. In 1915 pigs packed in boxes in powdered peat and in common salt evaporated considerably in 6.5 months' storage, and the flavor was only fairly good.

(Feeding experiments with beef cattle, brood sows, and work horses) *Minnesota Sta., Rpt. Duluth Substa., 1916, pp. 7-9, 10, 11*.—In 1916 young of animals were pastured without extra feed on range a part of which was fine grass pasture. Three of the yearlings were on grass 49 days and seven 27 days. They made an average daily gain of 1.59 lbs. per head.

Brood sows on pasture from June to September, inclusive, slightly increased weight when receiving $\frac{1}{2}$ lb. of grain per 100 lbs. live weight, whereas before and after the pasture period they consumed 1 lb. of grain per 100 lbs. live weight. Six work horses were pastured at night on stump-land pasture from June to August, inclusive. During the three months the night pasture resulted in a saving of 12 lbs. of hay and 1 lb. of grain per head daily.

In a test of a self-feeder for pigs on a ration of tankage shorts, ground barley, and skim milk, 13 pigs made an average daily gain from June 15 to October 15 of 118 lbs. per head at cost for grain of \$4.69 and a profit of \$11.80.

A feeding trial with a litter of fall pigs is also noted.

The theory of correlation as applied to farm-survey data on fattening baby beef, H. R. TOLLEY (*U. S. Dept. Agr. Bul. 504 (1917), pp. 14*).—This bulletin gives the results of an experiment in applying the theory of correlation to the study of some of the data obtained by the Office of Farm Management in a survey of corn-belt farms upon which baby beef was being fattened for market, the details of which have already been noted (*E. S. R.*, 35, p. 663). The factors here considered are the profit or loss per head, the weight, value per 100 lbs., value of feed consumed per head, cost at weaning time, and date of sale. Coefficients of correlation were computed and tabulated for every pair of these factors and used as a measure of the relationship existing between them.

The author concludes that "data such as those obtained by farm management surveys can be analyzed very thoroughly by the use of the correlation coefficients. It is generally known before the analysis is attempted which factors are causal and which resultant, and consequently there should be very little difficulty in interpreting the coefficients correctly. The coefficients of correlation afford a very good means of determining the net effect of each of several factors bearing upon a result, or of eliminating the effect of other factors when it is desired to find the true relationship existing between any two."

"Although it is not possible to give a definite concrete meaning to correlation coefficients, they are very concise relative measures of the degree of relationship existing between the factors being studied. They therefore give the investigator a single index which will show what, by the ordinary tabular method, it takes a whole table to show. While properly constructed tables will show whether or not any relationship exists between factors, it is a difficult matter to determine which of two causes, say, has the greater effect on the result, and it is impossible, without a large number of records and a great amount of sorting and tabulation, to separate all the factors being considered in a study and find the effect that each one would have had if the others had not been present, or if they had been constant throughout the investigation."

"If the gross coefficients of correlation between every pair of factors have been determined, it is possible to find these relationships by simply substituting the formula for determining a net coefficient from the gross coefficients, without any further reference to the records themselves. This method should be especially useful if only a limited number of records or observations are

available, for it does away with the necessity of sorting into many groups with the consequent falling off in the reliability of the averages obtained."

The analysis of the data on fattening baby beef animals indicates that "for the herds considered, the cost of producing the calves and carrying them until weaning time was by far the most important factor in determining the profit. There was no connection between the cost at weaning time and any of the other factors, for the calves which were produced cheaply were seemingly just as good feeders and brought just as good a price per pound as the more expensive ones. The weight at which the calves were sold and the date of sale had very little effect on the profit, except for the fact that in the two years of the records the price was higher in the latter part of the summer, at the time when the heavier calves were put on the market. The calves which consumed the heaviest ration sold at higher prices than the others, but did not return a correspondingly greater profit, as the advanced price scarcely offset the extra value of feed consumed."

Steer feeding.—X. Winter steer feeding, 1913-14, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 178 (1914), pop. ed., pp. 8*).—A brief summary of experiments already noted (E. S. R., 33, p. 371).

Sheep feeding.—IV. Fattening western lambs, 1913-14, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 178 (1914), pop. ed., pp. 8*).—A brief summary of experiments already noted (E. S. R., 33, p. 374).

[Feeding experiments with pigs in Minnesota] (*Minnesota Sta. Rpt. 1916, pp. 45, 72*).—In a comparison of hand feeding with self feeding, 100 pigs in ten lots were fed solely on grain rations consisting of various mixtures of shelled corn, shorts, tankage, ground barley, and linseed meal. In every case, the self-fed pigs made larger daily gains than those fed twice daily by hand.

Rape pasture supplemented with 2, 3, and 4 per cent shelled-corn rations gave average daily gains per pig of 0.61, 0.81, and 0.93 lbs., respectively. Valuing corn at 75 cts. a bushel, and pasture at \$10 an acre, the actual feed cost per pound of gain was 4.6, 4.46, and 4.81 cts., respectively.

Results at the Crookston substation are noted on page 268 and below.

The fall litter of pigs, W. DIETRICH (*Minnesota Sta., Rpt. Crookston Substa., 1910-1916, pp. 93-95; Minnesota Sta. Rpt. 1916, p. 72*).—Suggestions are given for the successful raising of fall pigs under northern Minnesota conditions.

Twelve pigs born about September 1, 1915, were weaned and put on feed November 22 and fed until the following May. The rations consisted of barley, oats, and tankage, to which corn was added at the beginning of the eleventh week, and a little rye during the last week of the test.

In addition to the above feeds and water these pigs had a small quantity of a 1 per cent solution of concentrated lye, and were also given access to ground limestone and bone meal. At eight months these pigs averaged 255 lbs. each. They required 5.42 lbs. of feed per pound of gain.

[Clover pasture for hogs] (*Minnesota Sta., Rpt. Duluth Substa., 1915, pp. 5, 6*).—In a feeding test with three sows during July and August, it was found that dry brood sows may be maintained on good clover pasture with practically no grain if they are mature, but that a light grain ration is desirable if they are growing.

[Report of the] Kansas state live stock registry board (*Kansas Sta. Insp. Bul. 1 (1915), pp. 239*).—This gives data as to the effect of the stallion license law on the horse-breeding industry of the State, a report of the sixth annual meeting of the Kansas Horse Breeders' Association, a summary of the results secured at the Kansas Station in experiments upon developing draft colts (E. S. R., 36, p. 172), and lists by counties and breeds of stallions licensed in the State during 1915.

Feeding for egg production. P. Meone (*Idaho Sta. Circ. 3* (1916), pp. 6).—Results are given of a feeding experiment which began November 1, 1914, and ended October 31, 1915, with three pens of 30 White Leghorn pullets each. The following rations were fed: Pen 1, a scratch feed of wheat, oats, and barley (15:2:2), and no mash; pen 2, a scratch feed of wheat, peas, oats, barley, Kafir corn, millet, sunflower seed, and buckwheat (12:2:3:2:1:1:5:15:1), and a dry mash of bran, shorts, corn meal, wheat meal, fish-meal meal, and charcoal (2:2:1:1:2:1); and pen 3, the same as pen 2 except that corn was substituted for peas in the scratch mixture, and the proportion of oats and barley slightly increased. All the fowls were given green feed in some form throughout the year.

The fowls in pen 1 failed to keep in flesh, and those in pen 3 maintained more uniform weights than those in pen 2, indicating that corn is essential in a well-balanced poultry ration. During the year pen 1 laid 739 eggs, 66½ per cent of which were under 2 oz. in weight; pen 2 laid 3,486 eggs, 5.5 per cent of which were under 2 oz.; and pen 3 laid 3,338 eggs, 6½ per cent of which were under 2 oz.

Notes are given on balancing poultry rations.

Poultry feeding test, home-grown versus purchased feeds (*Minnesota Sta. Rpt. Duluth Substa., 1916, p. 11; abs. in Minnesota Sta. Rpt. 1916, p. 79*).—Two pens of 40 White Leghorn hens each were fed during January, February, and March, 1916. In addition to other feeds the hens in the purchased-feeds lot received corn and meat scrap and those in the home-grown-feeds lot, barley, milk, and peas. The former lot laid 476 eggs and the latter 499 eggs within the three months.

DAIRY FARMING—DAIRYING.

The dairy industry in Argentina. P. BERGES (*Am. Soc. Rural Argentine, 50* (1916), No. 2, pp. 81-131, figs. 21; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7* (1916), No. 9, pp. 1357-1362).—The author treats of the present state of the dairy industry of Argentina, sanitary inspection of milk and butter, testing of milk intended for human consumption and butter making, economic returns of the dairy industry, a comparison of the dairy industry of Argentina with that of other countries, and plans for the development of the dairy industry in Argentina.

Net value of pasturage (*Minnesota Sta., Rpt. Duluth Substa., 1915, pp. 7, 9*).—Five acres of pasture land seeded after clearing maintained an average of three cows and two heifers for 30 days the first year after seeding, during which time the total returns of beef and milk fat amounted to \$5.33 per acre. It is estimated that this pasture land gave a total return of \$10 per acre for the whole season.

[**Pasturing experiments with cows at the Duluth substation**] (*Minnesota Sta., Rpt. Duluth Substa., 1916, p. 7*).—Continuing the work noted above, 4 cows were pastured on the same 5-acre tract for 137 days in the summer of 1916, receiving in addition 1 lb. of grain to each 4 lbs. of milk produced. During this time the cows produced 497.83 lbs. of milk fat. Valuing the milk fat at 23 cts. per pound and the grain fed at \$25.95, the pasture was worth \$13.83 per acre for the season.

[**Record of dairy herd at the Grand Rapids substation**] (*Minnesota Sta. Rpt. 1916, pp. 75, 76*).—Data are tabulated showing the results of five years' work in breeding up a herd of common cows by the use of pure-bred Guernsey sires.

It is noted that the average annual milk production per cow increased from 5,300.9 lbs. in 1911 to 5,721.2 lbs. in 1915. During this time the average fat content of the milk increased from 4.27 to 4.9 per cent, and the annual milk-fat production per cow from 226.6 to 279.8 lbs.

Studies in milk secretion, I, II, J. HAMMOND and J. C. HAWK (*Jour. Agr. Sci. [England]*, 8 (1917), No. 2, pp. 139-153, figs. 2).—Two articles are presented.

I. *The effect of nutrition on yield and composition* (pp. 139-146).—Using well-fed goats, a study was made of changes in the yield and composition of the milk which followed a sudden change in nutrition. The changes in nutrition were brought about by the administration of phlorizin, together with the control of the food supply.

When food was withheld from goats for a short time and then an abundant supply given them, the amount of milk and fat secreted was decreased and the percentage of fat increased, due to the lowering of the plane of nutrition. When food was withheld, phlorizin injected, and a few days afterwards a plentiful supply of food given, results similar to those above, yet much more marked, were secured. The return to normal production was very gradual, indicating that phlorizin has a rather long-continued action. In two cases out of the three, the fat percentages at the end of the experiment was below that at the beginning, although the milk yield had not returned to normal. In a third series of experiments phlorizin was injected into goats under normal conditions of feeding. There was great variation in the effects on different individuals, the results indicating that it was the goats in the poorest state of nutrition that showed a diminution in milk yield as a result of the injection of phlorizin.

II. *The relation of the glands of internal secretion to milk production* (pp. 147-153).—The effect of pituitary extract on the milk flow of animals under conditions of reduced nutrition was studied. Goats were injected with 1 cc. of pituitary extract per head daily during a period of sudden change from a high to a low condition of nutrition. This change was brought about by withholding food or by the injection of phlorizin as in the experiments noted above.

The results indicate that the amount of milk produced by the action of pituitary extract varies with the state of nutrition. It was found that the variation in yield as a result of pituitary injections was not so great as the normal daily variations. The percentage of fat in the milk produced within half an hour after the injection of pituitary extract rises with the fall in nutrition, as it does in the case of normal milk.

A study was made of the effect of the injection of adrenalin into lactating goats. In these tests an average of 6 cc. of a 1:1,000 solution of adrenalin chlorid was injected into each goat on alternate days after the morning milking, the goats being milked again after an interval of half an hour. On the other days sterilized water was injected in place of the adrenalin. The injection of the adrenalin had no immediate effect on the amount of milk secreted, but there was a secondary effect causing a decrease in the amount of milk produced for a day following the injection. The percentage of fat in the milk was increased, but the amount of fat was somewhat decreased following the injection of adrenalin.

The results of these experiments indicate that the rate of milk flow is very susceptible to changes in the sugar metabolism of the animal.

On the fat of Egyptian buffalo milk, G. HOGAN and E. GRIFFITHS-JONES (*Dept. Pub. Health [Egypt], Hyg. Inst. Pub. 5* (1916), pp. 3).—Analyses are given of 69 samples of buffalo milk fat, each sample being representative of the mixed milk of a complete milking of five or six buffaloes.

The maximum figures obtained were Reichert-Melsl value 37, Polenske value 2.8, saponification value 235, Hübl's iodine value 39.7, and butyrol-refractometer reading at 40° C. 44. The corresponding minimum figures were 24.5, 1.8, 23, and 40.4, and the average, 31.2, 1.5, 229, 31.4, and 42.5, respectively.

Variations in the composition of human milk during the first eleven days after parturition. F. S. HAMMETT (*Jour. Biol. Chem.*, 29 (1917), No. 2, pp. 12-329).

—A study is reported of variations observed in the chemical composition of human milk during the first 11 days after parturition. The milk production of eight women was studied.

There was an increase in the amount of fat and lactose during the period, while there was a falling off in the production of protein. It is stated that the protein mechanism is apparently the best regulated, and is less dependent upon the factors controlling the fat and lactose production than they are on each other. For the single constituents there was found to be a production more uniform for the individual subject. This plane of production is apparently not for the individual, independent of the plane of nutrition, and dependent upon the individuality. An increase or decrease in the lactose production was usually accompanied by a change in the opposite direction in the percentage of fat and protein.

A bibliography is included.

A new defect in milk caused by *Bacterium lactis aerogenes*. M. DUGGILL (*Ztschr. Gärungsphysiol.*, 5 (1916), No. 5, pp. 321-349; *abs. in Internat. Inst. Agr.* [Rome], *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 9, pp. 1363, 164).

—Attempts were made to discover the cause of a bitter taste and typical acid-smell in bottled milk produced under sanitary conditions in a herd of cows. No bitter substance could be discovered in the milk, but it was found that the defect was due to one cow with a diseased udder. A bacterium belonging to the group *B. lactis aerogenes*, and thought to be the cause of the defect in question, was isolated from specimens of the mixed milk. This bacterium gave rise to an abnormal smell and taste, possessed the property of making glucose bouillon very ropy, and prevented the coagulation of milk in the presence of *B. guntheri*. It lost the characteristic taste and smell when cultivated on lactose agar, but these reappeared in part when the organism was cultivated in a suitable medium.

An epidemic of septic sore throat due to milk. E. C. ROSENOW and C. L. V. HESS (*Jour. Amer. Med. Assoc.*, 68 (1917), No. 18, pp. 1365-1367, fig. 1).—An account is given of an outbreak of severe sore throat in Galesville, Wis., involving about 200 persons, the cause of which was traced to three cows on one farm, affected with mastitis.

Septic sore throat. G. W. HENIKA and I. F. THOMPSON (*Jour. Amer. Med. Assoc.*, 68 (1917), No. 18, pp. 1367-1369, fig. 1).—This is an epidemiologic study of the milk-born epidemic noted above.

Spring conditions affecting the cream producer. H. A. RUEHE (*Illinois Sta. Circ.* 195 (1917), pp. 4, fig. 1).—Suggestions are given for overcoming some of the more common troubles that affect the production of high-grade cream under spring conditions.

Manufacture and composition of Bulgarian cheeses. A. S. ZLATAROFF (*Ztschr. Untersuch. Nahr. u. Genussmittel*, 31 (1916), No. 12, pp. 387-394; *abs. in Internat. Inst. Agr.* [Rome], *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 9, pp. 1364-1367).—A description is given of Bulgarian and Kaschkawal cheeses, which, it is stated, make up the bulk of the total output of cheese in Bulgaria. Information is included on the importance of cheese making in Bulgaria.

Rennet substitutes. (*N. Y. Produce Rev. and Amer. Cream.*, 43 (1917), No. 22, pp. 906, 908, 909).—A brief symposium is given on the use of rennet sub-

stitutes in cheese making. Results of cheese making experiments at the Fine dairy station in Ontario, Canada, in which several commercial brands of pepsin and rennet were tested, and notes on the use of pepsin in cheese making as summarized by J. A. Huddick and G. H. Barr. In these experiments the pepsin cheese was found to be as good in texture and slightly better in flavor after nine months' storage than that made from rennet. The relative value as milk-coagulating power of the various brands tested are tabulated.

VETERINARY MEDICINE.

American Veterinary Medical Association.—Report of committee on diseases, J. R. MOHLER (*Jour. Amer. Vet. Med. Assoc.*, 50 (1917), No. 7, pp. 583-593).—This report consists of a brief statement regarding the status of the more important diseases which threaten the live-stock industry of the United States, including hemorrhagic septicemia, hog cholera, foot-and-mouth disease, dourine, tuberculosis, swamp fever, contagious abortion, and influenza.

Sixteenth biennial report of the State Live Stock Sanitary Commission of Michigan for the years 1915 and 1916, G. W. DUNPHY and E. T. HALLMAN (*Bien. Rpt. State Live Stock Sanit. Com. Mich.*, 16 (1915-16), pp. 31, pls. 4). This report deals with the work of the years 1915 and 1916 including the occurrence of and control measures against tuberculosis, hog cholera, contagious abortion, hemorrhagic septicemia, rabies, and anthrax.

Annual administration report of the civil veterinary department of Baluchistan for the official year 1915-16, J. G. CATTELL (*Ann. Admin. Rpt. Civ. Vet. Dept. Baluchistan, 1915-16*, pp. 16).—This report deals with veterinary instruction, treatment of disease, including the occurrence of and work with the contagious diseases of animals during the year, breeding operations, etc.

Annual administration report of the civil veterinary department, Madras Presidency, for 1914-15 (*Ann. Admin. Rpt. Civ. Vet. Dept. Madras, 1914-15*, pp. 26, pl. 1).—This report includes accounts of the occurrence and treatment of diseases of live stock in the Madras Presidency during 1914-15.

Studies in pneumonia.—II, Various methods of determining the bactericidal action of substances in vitro and their relation to the chemotherapeutic therapy of bacterial infections, J. A. KOLMER, S. SOLIS-COHEN, and G. I. HEIST (*Jour. Infect. Diseases*, 20 (1917), No. 3, pp. 293-312).—The authors have carefully studied, and modified in some instances, the Rideal-Walker and Hygienic Laboratory methods, the centrifuge method, pipette method, combined in-vitro-vivo method, antiseptic method, and plating method.

It is concluded in general that in-vitro bactericidal tests are probably of value in chemotherapeutic studies, this being based on the general observation that substances most parasitocidal in vitro also show this quality in marked degree in vivo. "In-vitro tests should be conducted when possible with the micro-parasite causing the malady under study, as the object of chemotherapy should be the production not only of polybacteriotropic and polyprotozootropic chemicals but also of monotropic substances for a definite micro-parasite. In the absence of a pure culture of the particular micro-parasite under study, a closely allied species may be used. . . . It is highly important to adopt a definite technique and adhere to it in every detail in conducting these tests, because different methods yield varying results, depending mainly on whether the substance excels as a bactericide (killing quickly in high concentration, but losing rapidly in bactericidal power in low concentration) or as an antiseptic (retaining bactericidal power to a better extent in low concentration)."

The procedures are described in detail, discussed, and some experimental results submitted. See also a previous note by Kolmer, Schamberg, and Raiziss (*S. R.*, 30, p. 679).

The differentiation of the paratyphoid-enteritidis group, I. E. O. JORDAN (*Jour. Infect. Diseases*, 20 (1917), No. 4, pp. 457-483).—The cultures of bacilli belonging to the paratyphoid-enteritidis group that were examined by the author and are here considered fall into four subdivisions, namely, *Bacillus paratyphosus* A, *B. paratyphosus* B, *B. suispestifer*, and *B. enteritidis*.

The enzymes of the tubercle bacillus, H. J. CORPES and H. C. SWEANY (*Jour. Biol. Chem.*, 29 (1917), No. 2, pp. XXI, XXII).—It is noted that tubercle bacilli, both human and bovine, possess autolytic enzymes, as is indicated by the liberation at incubator temperature of noncoagulable nitrogen and amino acid-nitrogen after the organisms have been killed by toluene and chloroform. The bacilli themselves, or autolyzates therefrom, also possess a trypsin-like enzyme capable of cleaving proteins in alkaline solution, a weak pepsin-like enzyme active in acid solution, an erepsin-like enzyme capable of cleaving glucose in acid solution, a nuclease which acts on nucleic acid, and a urease. Starch-hydrolyzing or saccharose-inverting enzymes or enzymes capable of digesting elastic tissue prepared from lamb's lung or connective tissue prepared from tubercles could be demonstrated by the methods used for detecting these enzymes. It is indicated that the demonstration of the latter enzymes must be by indirect methods, and the results are therefore not conclusive.

The immune reaction to tuberculous infection, R. WEIL (*Jour. Amer. Med. Assoc.*, 68 (1917), No. 13, pp. 972, 973, *figs. 2*).—From some data obtained by exposing the uterus from a sensitized animal in Locke's solution and determining the effect of the antigenic substance on its muscular contractions, the author indicates that "It is clear that these antibodies must be considered to be cellular or 'sessile,' since it is only on this theory that the response of the isolated organ can be explained. It is not to be supposed that the uterine dis is the only ones of the body which contain the specific antibodies. In fact, it is highly probable that many, if not all, of the tissues of the body are similarly altered by tuberculous infection. . . . If this be the case, it seems highly probable that the various types of altered reaction, . . . whether local or general, are to be explained on the basis of cellular sensitization to the agent of the disease and to its products. The details of the mechanism of these reactions, as well as of the partial immunity of the infected animal, will perhaps be found to correspond to analogous conditions in general anaphylaxis."

The treatment of experimental tuberculosis in guinea pigs and rabbits with taurin, alone and in combination with gold chlorid and sodium oleate, I. TAKEOKA (*Jour. Infect. Diseases*, 20 (1917), No. 4, pp. 442-456).—Experimental data of a study of the curative value of taurin alone or in combination with a colloidal mixture of sodium gold chlorid and sodium oleate in experimental tuberculosis in guinea pigs and rabbits are reported. The guinea pigs were infected with either bovine or human strains of the organisms, the results being similar in both cases.

In general the control animals died before any of the treated animals, and whereas the controls lost weight almost uniformly, the treated animals gained. The majority of the treated animals were killed for observation many days after the controls had died, and the contrast in the extent of visible tuberculosis was marked. While the process was found to be advanced in the controls, it was arrested and in some instances apparently cured in the treated animals.

Rabbits were infected with intraperitoneal or intravenous injections of the ovine strain. The treatment was carried out by intravenous injections of

taurin alone, the results being similar but even more marked than in the experiments with guinea pigs. Histologic examination of the organs in treated animals showed arrested tubercles, absence of caseation, disappearance of the tubercle bacilli and lesions, and evidence of repair by connective-tissue in growth. The controls showed advancing lesions, caseation, and numerous bacilli. A number of the treated animals showed slight evidences of tuberculosis, but no inconsiderable number were the tissues essentially normal microscopically.

Suppuration in cattle and swine caused by *Bacterium pyogenes*, A. I. WARD (*Cornell Vet.*, 7 (1917), No. 1, pp. 29-42, pl. 2).—This discussion of the general characteristics of the lesions and of those found in swine and in cattle is based upon investigations and an extensive review of the literature in connection with a list of 15 references appended.

"*Bacillus pyogenes* differs from the common pyogenic organisms in that it possesses the peculiarity, under certain conditions, of stimulating the proliferation of connective tissue to form tumor-like masses similar to granulation tissue, and of subsequently inducing the necrotic changes leading to the formation of an abscess within the newly formed tissue. This type of suppuration is a consequence of the preliminary tissue proliferation follows a slow chronic course. In this peculiarity the development of the lesions of *B. pyogenes* bears a general resemblance to the changes occurring in tuberculosis and in actinomycosis."

B. pyogenes is deemed undoubtedly the most common suppurative organism affecting swine. Abscesses caused by it may develop in all parenchymatous visceral organs, the walls of the gastro-intestinal canal, the musculature, and the subcutis. It is also said to be quite as important in cattle as in swine.

The diastase in the saliva of the ox, C. C. PALMER (*Vet. Alumni Quar. [Ohio State Univ.]*, 4 (1916), No. 2, pp. 44-52).—Previously noted from another source (*E. S. R.*, 36, p. 82).

The diagnosis of infectious abortion of cattle (Bang's disease) with special reference to the intradermal abortin test.—I. Review of Bang's disease J. REICHEL and M. J. HARKINS (*Jour. Amer. Vet. Med. Assoc.*, 50 (1917), No. pp. 847-862, figs. 4).—This is a general discussion of the subject with regard to history, symptoms, bacteriological examinations (microscopic and cultural), and biological tests (serological and diagnostic reagents), together with detailed tabulated data on the use of the "abortin" test as introduced by the British commission (*E. S. R.*, 22, p. 534) and also tested by Meyer and Hardenbergh (*E. S. R.*, 31, p. 380).

The abortin used was prepared by removing from six to eight strains of *Bacillus abortus*, which were grown in Blake bottles of neutral glycerin agar at 37° C. until their maximum growth was obtained, with sterile physiological salt solution, collecting as one mixture, heating to 60° for one hour, and centrifugalizing. The killed bacteria were then once more washed with physiological salt solution and the emulsion shaken up in a mechanical mixer with a definite amount of the saline and filtered through four thicknesses of sterile cheesecloth. The filtrate was so diluted that each cubic centimeter included approximately 5,000,000,000 bacteria, cultured for sterility and preserved with 0.5 per cent phenol. It was applied in the test in a manner similar to the intradermal tuberculin test as used by Haring and Bell (*E. S. R.*, 30, p. 883).

It is indicated that the intradermal test is hardly destined to assist in establishing a diagnosis, as far as the individual animal is concerned, but as an aid in determining whether or not the infection actually exists in a herd it is a valuable test for the practicing veterinarian. "As much can be said for a positive reaction in the test as a positive reaction in any of the serological tests, and when the history of the herd is such as to arouse the suspicion that

the disease may exist, then positive reaction with the intradermal abortin in several animals would show that the suspicion is well founded, whereas firmly negative results would tend to indicate that the infection was not present.

Outside of clinical observations, including the history of the herd and actions made of material aborted, the veterinarian must rely on the results of tests that include laboratory procedures, the results of which as a rule are difficult to interpret. . . . When the results of the bacteriological or serological tests are available the results of the intradermal abortin test can be used as additional confirmation, and if circumstances prevail where bacteriological or serological tests can not be made then the intradermal abortin test can serve as an additional means or procedure open to the veterinarian in the future."

Formalin in the treatment of mastitis. J. N. FROST (*Jour. Amer. Vet. Med. Ass.*, 51 (1917), No. 1, pp. 85-88).—The author reports having obtained satisfying results from the administration of formalin by mouth in the treatment of infectious mastitis. In his experiments 25 cc. of formalin given to a cow undiluted in capsules twice daily for two weeks failed to produce ill effects in any way, either by loss of appetite, constipation, or emaciation. Fifty cc. was also given at one time without ill effect. Five cases of mastitis cured by this treatment are reported.

When one dram of formalin was given faint traces could be found in the milk in 24 hours. When 25 cc. was given three hours after water and seven hours after milking it was found in the milk two hours afterwards and continued to be present for 48 hours.

Radication of the cattle tick in Argentina. A. AYERZA, F. SIVORI ET AL. (*Soc. Rural Argentina*, 59 (1916), No. 6, pp. 582-584).—A plan for the eradication of the cattle tick in Argentina, prepared by a commission appointed by the Minister of Agriculture, is presented.

Notes on a fatal parasitic infestation in a herd of cattle and goats in the province of Ambos Camarines. W. H. BOXTON and L. D. WHARTON (*Philippine Agr. Rev. [English Ed.]*, 9 (1916), No. 4, pp. 348-353).—This paper reports on the occurrence in the Province of Ambos Camarines of helminths in cattle and goats which had succumbed to their attack. The helminths dealt with are *Ostomum phlebotomum*, *Oesophagostomum columbianum*, *Oesophagostomum Hammondii contortus*, *Trichuris ovis*, *Filaria labiato-papillosa*, nematode species, and *Paramphistomum* sp.

Louping-ill. S. STOCKMAN (*Jour. Compar. Path. and Ther.*, 29 (1916), No. 3, 244-264).—This article, which deals particularly with the possibility of transmission of this disease by ticks, includes reports of experiments in which the tick theory was tested.

The experimental evidence so far is against the view that louping-ill is a disease carried by ticks. There still remains to be tested by direct experiment, however, the possibility of ticks acquiring infection when sucking as they remain noninfective in the nymphal stage, and developing infectivity in adults."

The author concludes that until the experiments now being carried out have been completed it will be unwise to conclude that louping-ill is not a tick-borne disease.

Roundworms of sheep. B. H. RANSOM (*U. S. Dept. Agr. Rpts.* 1916, pp. 127-131).—During 1915 nematode experiments were made at Vienna, Va., with approximately 100 ewes and lambs separated into four lots. The first lot was kept continuously on the same pasture from May to September. The second lot was kept on a double pasture from May to September, grazing alternately

two weeks in each of the two parts. The animals in the third lot were grazed separately and moved every week to fresh ground or ground not recently grazed, but were allowed together at noontime and night, when they were together in a barn with slat floors which was cleaned and disinfected at least once a week. The fourth lot was moved once a week from May to September to fresh pasture and was kept together most of the time, the ewes occasionally being separated from the lambs and grazed on infested pasture when the available fresh pasture was limited.

At least five lambs from each of the lots were killed and examined in September or later, but no material difference was observed in the degree of stomach worm infestation in the various lots. A great reduction in the number of stomach worms present occurred in all of the lots after November 1, as a rule only a comparatively few individual worms being found instead of the usual thousands found in the lambs or ewes examined earlier.

With reference to hookworms, nodular worms, lungworms, and tapeworms, there was no important difference between the first and second lots. The lambs of the third lot showed hookworms in only one case and then only two specimens. They had few and in some cases no nodular worms or worm nodules, no tapeworms, and no lungworms. The lambs in lot 4 also had comparatively few hookworms, nodular worms, and worm nodules, only one having lungworms and none tapeworms.

These experiments apparently indicate that the plan followed as to change of pastures can not be depended upon to control parasitic infestation in lambs, especially in the case of the stomach worm, although, on the other hand, it appeared that a change of pasture every week during the season from May 1 to September 1 kept down the infestation of lambs with hookworms, nodular worms, lungworms, and tapeworms to a very small amount. It thus appears that these parasites can be more easily controlled than the stomach worm by a system of pasture rotation. "The probable meaning of the presence of only a few stomach worms in sheep during the winter following a summer in which they were comparatively numerous in other sheep of the same flock is that the average length of life of the adult stomach worm is not more than a few weeks or months; in brief, that the stomach worm is essentially a short-lived parasite."

The influence of partial thyroidectomy in pigs, C. C. PALMER (*Amer. Jour. Physiol.*, 42 (1917), No. 4, pp. 572-581, fig. 1).—The results of a study by the author at the Veterinary Research Laboratories of the Minnesota Experiment Station show that the extirpation of the main thyroid gland in young pigs does not induce cretinism, at least within a period of nearly one year. A slight retardation of growth was observed, but the operated pigs otherwise acted similarly to the controls except that they showed a marked lowered resistance to infection. A marked hypertrophy of the accessory thyroid tissue was observed on post-mortem examination of the thyroidectomized pigs.

It is indicated that "the main thyroid gland plays an important part in the normal body resistance to infection, and when this structure is removed the accessory thyroids can not completely compensate. In pigs a degree of hypothyroidism not sufficient to lead to marked changes in physical appearance of the animal lowers the resistance to infection to quite a degree, and impairs the functions of reproduction."

Fetal athyrosis.—A study of the iodine requirement of the pregnant sow, G. E. SMITH, with the cooperation of H. WELCH (*Jour. Biol. Chem.*, 29 (1917), No. 2, pp. 215-225).—The authors, at the Montana Experiment Station, have studied the condition of the birth of hairless and otherwise defective pigs

ch has been reported from western North Dakota and South Dakota, Washington, Minnesota, and western Canada.

The affected pigs when born are of full size and occasionally larger than normal. They are, however, strikingly weak and low in vitality, although born of apparently normal sows. Except for a few hairs on the nose and a ring around the eyes, the skin is smooth, shiny, and bald. This hairless condition is, however, very variable. The skin, particularly around the shoulders, back and feels pulpy, but on incision no fluid escapes, although it appears watery. The hoofs are thin-walled, short, brittle, and in an undeveloped condition. The thyroid is dark red and sometimes almost black, and histological examination shows a uniform hyperplasia and a distention of the blood vessels. Microscopical examination of the thyroids showed the iodine content to be extremely low in comparison with normal glands. In general, the iodine content of a diseased gland was found to vary inversely with the hairlessness of the animal. Glands of the affected pigs also showed a large accumulation of iron. The data are presented in tabular form.

Pregnant sows in the affected districts which were fed potassium iodide desiccated sheep thyroid in the last four or five weeks before farrowing a birth to strong and vigorous young, while the young of the control animals were weak, dull, and lacked vitality. The significance of the iodine feeding is apparent.

It is concluded in general that an iodine deficiency during the gestation period causes a lack of function and hyperplasia of the fetal thyroid, resulting in an arrested development of the fetus. "If more iodine were fed to the pregnant sows in large sections of this continent, especially during the winter months, young that they produce would be more healthy and more vigorous and a large number of weak and defective young animals that are produced annually would be greatly reduced. Fetal atrophy presents strong evidence that there is a direct relation between the physiologically active constituents of the thyroid and growth of the epidermal appendages. An abundant secretion of the fetal thyroid, during the later stages of the intrauterine life, is vital for the normal development of the fetus."

On the spirochetes of the digestive tract of swine and their relation to hog cholera, P. BERENSKY (*Rec. Méd. Vét.*, 92 (1916), No. 19, pp. 545-552).—The author has examined the intestinal tract of 100 hogs at an abattoir and found spirochetes in 58 per cent of the cases. The spirochetes were found not only in animals affected with hog cholera but also in animals affected with other diseases. It is indicated that in hog cholera these organisms might provoke secondary infection (as is often the case in infectious diseases), but that the disease is fundamentally due to the invisible microorganism. The data discussed are discussed in some detail.

Hog cholera, J. O. POWLEY (*Vet. Rec.*, 29 (1917), No. 1497, pp. 383-399).—This is a general discussion of the subject under the topics of history, etiology, pathology, post-mortem appearances, diagnosis, methods of infection, treatment, efficacy of serum, and a brief account of the preparation of serum.

A granulomatous affection of the horse—habronemic granulomata (cutaneous habronemiasis of Railliet). L. B. BULL (*Jour. Compar. Path. and Ther.*, 1916), No. 3, pp. 187-199, figs. 5).—"The granulomatous condition found on the penis and sheath, and infrequently in other situations, has the same etiology as summer sores. The parasite associated with the condition is a small nematode of the genus *Habronema*. This parasite is accidental, and probably can not maintain its life for longer than four weeks. The parasite is most certainly carried by a biting fly, and is accidentally inoculated during the feeding operations of the fly. The tissue reaction following the introduction

of the parasite leads to a tumor presenting a characteristic macroscopic and microscopic appearance. The affection known as swamp cancer in the Northern Territory of Australia is almost certainly a variation of the same condition.

"Prophylaxis should be in the direction of (1) ridding horses of the adult forms of the genus *Habronema* which are located in the stomach, and (2) in the destruction of feces which bear the embryos and which act as a breeding ground for flies. Complete excision of the lesion before it has become inoperable is the only treatment to be advised."

Sclerostome parasites of the horse in England.—II, New species of the genus *Cyllichnostomum*, C. L. BOULENGER (*Parasitology*, 9 (1917), No. 2, pp. 203-212, figs. 5).—This second part of the paper previously noted (E. S. R., 36, p. 280) consists of descriptions of three new species of the genus *Cyllichnostomum*.

Parasitic occurrence of *Elmeria stiedæ* in the liver of the dog, A. GUILLEREAU (*Schweiz. Arch. Tierheilk.*, 53 (1916), No. 11, pp. 596-602, figs. 6; *abs. in Rec. Méd. Vét.*, 93 (1917), No. 1-2, pp. 71-73; *Trop. Vet. Bul.*, 5 (1917), No. 1, pp. 5, 6).—The author describes two cases of the occurrence of *E. stiedæ* in the liver of dogs, 10 and 13 years old, respectively, in which great enlargement of the abdominal cavity was the most marked symptom during life. Cocciidiosis of the liver, although common in rabbits, is said to be very rarely found in the pig or dog.

Chick troubles, W. C. THOMPSON (*New Jersey Sta. Hints to Poultrymen*, 5 (1917), No. 7, pp. 4).—This circular discusses a few of the more common chick troubles, especially those that usually appear when chicks are brooded in large colonies.

Apparent recovery of a hen infected with bacillary white diarrhea as determined by the macroscopic agglutination test, G. D. HORTON (*Jour. Bact.*, 1 (1916), No. 6, pp. 625, 626).—The author reports upon the recovery of a Bantam hen, indicating the possibility of recovery or the throwing off of ovarian infection.

The part played by the goblet cells in protozoan infections of the intestinal tract, P. B. HADLEY (*Jour. Med. Research*, 56 (1917), No. 1, pp. 79-80, pl. 1).—"The present paper presents observations which demonstrate that, in the case of the flagellate protozoan, *Trichomonas*, the cause of an acute malady of several species of birds, notably the turkey (blackhead), the avenue of invasion of the subepithelial tissues is the goblet or chalice (gland) cells located in the fundus of the crypts of Lieberkühn. It is suggested that the passage of the parasites through these cells is not inadvertent, but due to a natural invasive power present in the motile flagellate trophozoite which accomplishes the infection of the deeper tissues."

Elmeria avium: A morphological study, P. B. HADLEY and ELIZABETH E. AMISON (*Arch. Protistenk.*, 23 (1911), No. 1-2, pp. 7-50, pls. 2).—Following an introduction and historical résumé the authors discuss the material, methods, and technique and the life cycle of the coccidium and the infectious process; and give a detailed description of the several stages of the coccidium, namely, the mature cyst, sporoblasts, sporozoites, schizonts, merozoites, macrogametes, microgametocytes, and microgametes.

A list of 37 references to the literature is included.

Coccidia in subepithelial infections of the intestines of birds, P. B. HADLEY (*Jour. Bact.*, 2 (1917), No. 1, pp. 73-78).—This is a brief report of studies of coccidia now in progress, in continuation of investigations above noted, in which the author considers in a preliminary way the bearing of certain of the observations upon the problem as discussed by Smith (*E. S. R.*, 35, p. 684).

"Although the full significance of the presence of merozoites and of other ages of *Eimeria arium* in subepithelial regions of the intestines can not yet be grasped, their frequency of occurrence there and their freedom from all appearances of degenerative changes lead us to assume that this phenomenon marks an ordinary phase of the normal infective process; and that so far as the coccidia are concerned, we must, as the writer pointed out some years ago, abandon the view that they are exclusive parasites of epithelial cells in the sense that they must occupy epithelial cells to complete their normal development."

Another case of the occurrence of the giant nematode, *Diectophyme imane*, in the abdominal cavity, and data bearing upon the theory of entry into the genito-urinary tract, W. A. RILEY (*Cornell Vet.*, 7 (1917), No. 1, pp. 45).—The data here presented supplement the account previously noted in S. R., 36, p. 80).

RURAL ENGINEERING.

Proceedings of the second, third, and fourth annual meetings of the Washington Irrigation Institution, December, 1914, January, 1916, and November, 1916 (*Proc. Wash. Irrig. Inst.*, 2 (1914), pp. 163, figs. 1; 3 (1916), pp. 144, figs. 1; 4 (1916), pp. 141, figs. 3).—These proceedings contain, respectively, the following special articles bearing on irrigation engineering:

Second meeting.—Experience with Canal Lining, by E. M. Chandler; Canal Lining Experience, by J. G. Heinz; Plant Growth in Canals, by F. C. Lee; Methods of Water Delivery, Rotation, and Size of Head, by M. Chase; Operation of the State Drainage Law, by W. B. Bridgman and J. O. Greenway; The Use of Electric Power in Pumping Water for Irrigation, by H. D. Hanford; Discussion of Drainage and Reclamation of Alkali Land, by H. E. Nicolai; Grouted Line in Irrigation Work, by C. D. Smith; Economy, Durability, and Efficiency of Water Distribution Systems, by A. B. Fosseen; Vitrified Clay Pipe for Irrigation and Drainage, by W. M. Watt; Irrigation District Laws, by B. Graves; The State College and Irrigation, by E. A. Bryan; The Farmer's Part in Irrigation Development, by S. Fortier; The Use of Metallic Flumes and Pipes in Irrigation Development, by G. L. Hess; and Duty of Water, by O. Jayne. Articles on Plaster Concrete Lining for Canals and Laterals, by Casteel; and Experience with Wood Stave, Concrete, and Steel Pipe, by M. Chandler, are appended.

Third meeting.—Irrigation Conditions, by E. F. Benson; Maintenance and Construction of Metal Flumes, by W. B. Armstrong; Uses of Concrete in Irrigation Development, by C. N. Reitze; Irrigation Pumping by Means of Electric Pumping, by G. Longmire; Irrigation Pumping, Other Methods, by S. B. Hill; Wood Pipe, Its Uses and Limitations, by T. A. Noble; and Conflicting Interests in Water Legislation, by W. F. Allison. Descriptions of irrigation projects in the State are included.

Fourth meeting.—Method and Time of Applying Water, by O. L. Waller; Good and Thin Metal Pipe, by T. A. Noble; Light Iron Pipes, by C. Casteel; The Value of Irrigation to the State, by M. Chase; Metal Flumes, by W. B. Armstrong; Metal Flumes as Canal Lining, by E. M. Chandler; The Agricultural Duty of Water, by J. C. Wheelon; Drainage, by G. Severance; Wooden Flumes, by W. F. Allison; Oil-Burning Engines, by J. B. Frem; and Cement Lining of Canals, by C. Casteel.

Flow through submerged rectangular orifices with modified contractions, J. M. CONZ (*U. S. Dept. Agr., Jour. Agr. Research*, 9 (1917), No. 4, pp. 97-114, pls. 13).—Experiments conducted at the Colorado Experiment Station in

cooperation with the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture are reported, which consisted of 317 observations, with 69 different combinations of sizes of orifices, sharp and thick edges, with and without gate guides, with and without small bottom contraction, with different depths of water in the channel of approach, and with different end contractions in the channel of approach and recession.

The results of the experiments are summarized and a consolidation of the expressions for the exponent and coefficient values of the head, h , "gives the general formula for the discharge through submerged rectangular orifices placed according to the conditions which have been taken as the standard:

$$Q = \left((4.8 + 0.1d)a \right)^{0.02d + 0.99} h^{1.435d + 0.06d - \frac{7.26a}{A}}$$

in which Q = the discharge in second-feet; d = depths of orifice in feet; a = area of orifice in square feet; A = area of cross section of water in channel of approach in square feet; and h = the difference in feet between the water levels upstream and downstream from the orifice."

The agreement of the discharge formula with the experimental data is shown to be within a mean of approximately 0.5 per cent, with a few individual exceptions, which are more than 1 per cent off.

The standard conditions are taken as follows:

"The total length of the orifice box is 16 ft., 10 ft. of which forms the channel of approach. Wings set at an angle of 90° are attached to the sides of the upstream end of the orifice box. The floor of the box is level throughout and at the same elevation as the bottom of the canal. The box should be set in the center line of the canal, so as to allow the water to enter the box in straight lines. The sides are parallel and are placed apart a distance equal to the length of the orifice plus 2 ft.

"Orifices of all sizes have end-contraction distances of 1 ft. The orifice must have sharp sides and top, and no bottom contraction. . . . The orifice must be placed with its greatest dimension horizontal. If it is desirable to use an orifice with bottom contraction, or with wood sides and top, or with gate guides and gate, the discharge tables may be corrected in accordance with the data given. . . .

"The elevations of the water levels in the channels of approach and recession should be taken in separate stilling boxes, one connection being 5 ft. upstream and the other 1.5 ft. downstream from the plane of the orifice. The connections should be through the side of the orifice box about 0.5 ft. above the floor line."

A few supplemental experiments are also reported.

The Venturi flume, V. M. COXE (*U. S. Dept. Agr., Jour. Agr. Research*, 5 (1917), No. 4, pp. 115-129, pls. 4, figs. 8).—"The purpose of this article is to present the fundamental plans and results of preliminary experiments on a new type of device, called the 'Venturi flume,' for measuring water in open channels."

The flume "consists essentially of a flume with a converging and a diverging section and short 'throat' section between them. The floor, which is level, is placed at the elevation of the bottom of the channel in which it is set. . . .

"The action of this device depends upon an adaptation or extension of Venturi's principle to the flow of a liquid in an open channel. As water passes through the flume there is a slight surface slope in the converging section, a rather sudden depression in the 'throat' section, and a rise in the diverging section. The actual loss of head is small. The determination of the flow

depends upon the velocity and wetted cross-sectional area at two points in the flume, and two gage readings, therefore, are necessary."

From the experimental data the formula for discharge through the V-notch Venturi flume is as follows:

$$Q = 6.68 H_b^2 [H_d - 0.14 H_a + 0.02]^2 + 0.01 H_a + 0.56] \sqrt{1 - \frac{H_d}{H_b^4} \frac{H_b^2}{(2 + H_a)^2 H_a^2}}$$

In this formula Q =the discharge in second-feet; H_a =the head at the gage in the up-stream section; H_b =the head at the throat section; and $H_d = H_a - H_b$.

The discharge through the Venturi flume with trapezoidal cross section, having side slopes of 1:1 in a plane normal to the axis of the flume and with a bottom throat width of 6 in., is represented by the following equation, which was derived in a manner similar to that given for the V-notch Venturi flume:

$$Q = \left[\frac{(H_d - 0.09 H_a - 0.005)^2 + 0.001 H_a + 0.274}{0.30} \right] (2 + H_b) H_b \sqrt{1 - \frac{2 H_d}{(2 + H_b)^2 H_b^2} \frac{H_b^2}{(2 + H_a)^2 H_a^2}}$$

"The Venturi flume is not an exact measuring device, but it is thought to be sufficiently accurate to meet usual practical needs, especially such as are encountered in irrigation practice in the West. Although experiments have been made only on the smaller sizes of Venturi flumes, it seems reasonable to expect that structures built according to the general plans will be applicable to the measurement of streams of considerable size with an accuracy compatible with field requirements. The Venturi flume seems to fulfill the conditions of being free of trouble from sand, silt, or floating trash; requires little loss of head for making the measurement; is a structure that is simple to build, easy to operate, and has a comparatively low cost; and is free from error in measurement due to aquatic growth or other changes in the channel, provided the floor of the flume is not below the grade of the channel."

Investigations of irrigation pumping plants, H. E. MURDOCK (*Montana Sta. Bul. 115* (1917), pp. 125-148, figs. 6).—Field and laboratory tests of pumping outfits, consisting of various combinations of engines and pumps for different heads, are reported. The results of the laboratory tests are summarized in the following table:

Summary of results of laboratory tests.

Kind of engine.	Kind of pump.	Engine rated horse-power.	Engine speed (revolutions per minute).	Pump speed (revolutions per minute).	Discharge of pump per second.	* Lift.	Fuel per foot acre-foot.	Lubricating oil per foot acre-foot.
					<i>Cu. ft.</i>	<i>Feet.</i>	<i>Gals.</i>	<i>Gals.</i>
Gasoline.....	Plunger.....	1	318	342	0.0540	10.0	0.940	0.24
Do.....	do.....	4	600	393	.0540	25.0	.573	.24
Do.....	do.....	4	584	392	.0191	50.0	3.120	.73
Do.....	do.....	1	318	342	.0619	50.0	1.050	.61
Do.....	do.....	1	318	342	.0550	8.2	3.480	.61
Do.....	do.....	1	318	342	.0570	8.2	3.480	.61
Do.....	do.....	1	318	342	.0590	8.2	2.510	.61
Do.....	Central 3-inch horizontal.....	4	585	342	.3447	10.0	.938	.24
Do.....	do.....	4	600	393	.6000	10.0	.848	.24
Do.....	do.....	5	584	392	.6000	10.0	.704	.06
Do.....	do.....	5	318	548	.6000	25.0	.674	.06
Do.....	do.....	45	274	548	.6000	25.0	1.528	.04
Do.....	do.....	45	272	1,055	.6000	50.0	.916	.04
Do.....	Central 5-inch vertical.....	5	424	676	1.2760	10.0	1.180	.03
Do.....	do.....	5	366	726	1.5000	10.0	.713	.05
Do.....	do.....	45	315	876	1.5000	25.0	.974	.05
Do.....	do.....	45	325	1,135	1.5000	50.0	.604	.03
Do.....	Central 7-inch vertical.....	45	314	336	3.0000	10.0	1.220	.07
Do.....	do.....	45	300	462	3.0000	25.0	.623	.01
Do.....	do.....	45	306	602	3.0000	50.0	.424	.01
Kerosene.....	Plunger.....	1	318	342	.0000	8.2	2.720	.61
Do.....	do.....	45	272	1,055	.6000	50.0	1.052	.04
Do.....	Central 3-inch horizontal.....	45	366	726	1.5000	10.0	.713	.05
Do.....	do.....	45	315	876	1.5000	25.0	.944	.05
Do.....	do.....	45	325	1,135	1.5000	50.0	.590	.05
Do.....	Central 7-inch vertical.....	45	300	462	3.0000	25.0	.625	.01
Do.....	do.....	45	306	602	3.0000	50.0	.416	.01
Steam, using coal.....	Central 3-inch horizontal.....	36	214	548	.6000	25.0	70.000	.03
Do.....	do.....	36	255	1,065	.6000	50.0	65.400	.03
Do.....	do.....	75	228	1,135	1.5000	50.0	28.500	.01
Do.....	Central 7-inch vertical.....	75	212	462	3.0000	25.0	28.300	.03
Do.....	do.....	75	212	602	3.0000	50.0	20.200	.03

The results of field tests are summarized in the following table:

Summary of field tests on horizontal centrifugal pumps.

Kind of plant.	Kind of fuel.	Engine rated horse-power.	Engine speed (revolutions per minute).	Diameter of discharge pipe.	Pump speed (revolutions per minute).	Discharge of pump per second.	Lift.	Fuel cost per unit.	Fuel per foot acre-foot.	Lubricating oil per foot acre-foot.
				<i>Inches.</i>		<i>Cu. ft.</i>	<i>Feet.</i>		<i>Lbs.</i>	<i>Gals.</i>
Steam engine.....	Lignite.....	75	170	6	370	2.33	12.65	\$3.00	103.00	0.0100
Do.....	do.....	75	206	6	332	3.06	37.60	3.00	40.10	.0070
Do.....	Coal.....	75	216	6	332	3.06	37.60	5.00	30.00	.0070
Do.....	do.....	65	205	18	257	15.12	14.23	4.00	37.80	.0065
Do.....	do.....	65	220	18	276	19.73	14.45	4.00	32.60	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	26.20	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	30.00	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	30.00	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	30.00	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	30.00	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	30.00	.0050
Do.....	do.....	65	219	18	275	20.21	14.50	4.00	30.00	.0050
Gasoline engine.....	Gasoline.....	12	130	6	251	1.60	4.60	.16	1.38	.0000
Do.....	do.....	12	135	6	294	1.45	4.35	.16	1.34	.0000
Do.....	do.....	12	128	6	248	1.61	4.50	.16	1.41	.0000
Do.....	do.....	12	127	6	247	1.65	4.42	.16	1.45	.0000
Do.....	do.....	15	210	6	373	2.72	12.00	.16	.75	.0000
Do.....	do.....	8	289	8	274	.97	11.50	.19	.75	.0000
Do.....	do.....	8	201	8	278	1.17	11.50	.19	.540	.0000
Kerosene engine.....	Kerosene.....	20	233	10	280	5.56	10.00	.11	.573	.0000

Brake and water horsepower and efficiency tests of three centrifugal pumps are reported in the following table:

Brake and water horsepower and efficiency of centrifugal pumps.

Kind of pump.	Head on pump.	Discharge per second.	Brake horsepower.	Water horsepower.	Efficiency.
	<i>Feet.</i>	<i>Cubic feet.</i>			<i>Per cent.</i>
Horizontal centrifugal.....	10	0.6	1,869	0.68	36.6
Do.....	25	.6	3,840	1.70	47.5
Do.....	50	.6	6,710	3.40	53.7
Vertical (submerged).....	10	1.5	3,456	1.70	49.2
Do.....	25	1.5	7,840	4.25	54.2
Do.....	50	1.5	14,480	8.50	58.7
Vertical centrifugal (submerged).....	10	3.0	7,800	3.40	43.6
Do.....	25	3.0	13,370	8.50	63.6
Do.....	50	3.0	21,840	17.00	71.3

Growth of moss in irrigation canals, Salt River Project, A. J. HALTOM *Reclam. Rec. [U. S.], 8 (1917), No. 4, pp. 191, 192.*—Studies of the growths of moss which obstruct the flow in the wide, shallow, low-velocity canals of the project led to the following conclusions:

"Moss does not grow in canals of high velocity. Neither does it flourish in canals that have uniform grades, but canals of uneven grades which contain low spots are very favorable for healthy growth. Moss does not grow in the absence of sunlight. It does not grow in canals with water depth of more than 1 ft. It flourishes best in canals with a silt bottom because the silt furnishes an excellent medium for root development. It obtains its healthiest growth in clear water. Muddy water retards but does not completely stop its growth."

The best results in experiments on control "were obtained with an Acme arrow. This machine was used with such satisfactory results that it is highly recommended for the removal of moss under conditions similar to those on this project."

Control of moss, weeds, and willows on the Minidoka Project, B. DUBBLE and T. W. PARRY (*Reclam. Rec. [U. S.], 8 (1917), No. 4, pp. 192, 193, fig. 1.*)—In experiments on the control of moss and weeds on the project during June the only method which was found successful in clearing the moss from the larger canals was by cutting with the Ziemsen submersible saw.

"This saw consists of a flexible band of steel with hooked teeth on both sides. It can be obtained in any length, and the weights to hold it to the bottom are adjusted to fit the canal. It is operated at an angle of about 30° with the cross section of the canal, the crew always working upstream. The rate of progress is from 6 to 12 in. at each double stroke and from 0.25 to 1 mile per day can be cut with each saw. The long streamers of moss when cut rise to the surface and float down to the next bridge or check, where they are browned out by men with pitchforks. . . .

"Where it can be done the cheapest and most effective method of cleaning the canal is to shut the water out entirely and let the ditch dry in the sun. Five to seven days' exposure is necessary ordinarily to kill the moss. This method kills the growth, but does not destroy the bulb. . . .

"During the 1916 season 200 miles of cleaning were done. The total cost of this work was \$4,200, making the cost per mile a fraction over \$16. The average cost per mile of the different methods is about as follows: Sawing and chaining late in the season \$8, cutting with scythes in laterals \$11, and spring-tooth harrow in laterals \$9. . . .

"Willows are cut by men with grubbing hoes and brush scythes. Men equipped with grubbing hoes go ahead for cutting out larger willows, and men with scythes follow and cut the remainder."

Drainage (*Minnesota Sta., Rpt. Crookston Substa., 1910-1916*, pp. 20-22, figs. 3).—This is a brief report on a seven years' test of a tile drainage system at the Northwest Substation at Crookston, Minn. The soil is a dark, sticky clay loam with a heavy compact bluish gray clay subsoil.

"Tile drainage is limited in operation to the period after the frost is out above them. This makes shallow surface ditches necessary for early spring drainage. Observations have emphasized the necessity of supplementing tile drains with surface ditches during the entire growing season in order to secure the best results. . . . The drainage system has been found to be of the greatest service. The two detailed inspections which have been made, in 1912 and 1916, showed the tile in as good condition as in other localities."

By-products of land clearing (*Minnesota Sta., Rpt. Duluth Substa., 1911*, pp. 9, 10).—The receipts per acre for lumber, cordwood, and fence posts were found to be \$62.08, with a total cost for clearing up to the stumping stage of \$57.39 per acre.

The soil saving dam, W. H. BAKER (*Univ. Missouri Agr. Ext. Serv. Circ. 13* (1917), pp. 4, figs. 31).—This circular describes and illustrates the construction of dams the purpose of which is to hasten the filling up of washed ditches on farms by preventing the sudden run-off of storm water.

A comparative bacteriological study of the water supply of the city and county of Denver, Colo., W. G. SACKETT (*Colorado Sta. Bul. 225* (1917), pp. 3-14, pls. 4, figs. 21).—This bulletin describes the water supply system of the city and county of Denver, Colo., and the methods of purification in use as reports comparative bacteriological tests of samples of the purified water made by four different experimenters, of which the author reported for the Colorado Station.

In these tests the results from the four sources were very uniform. Attention is called "to the excellent and safe condition of the filtered and treated water as shown by the low gelatin and agar counts and by the total absence of *Bacillus coli* from the main supply, complying in all respects with the standard adopted by the Public Health Service of the U. S. Treasury Department."

Data on the prevalence of typhoid in the city and county of Denver and the text of the ordinance protecting the watershed are also given.

The activated sludge process of sewage purification, E. ANDREX (*Jour. Soc. Chem. Indust., 36* (1917), No. 2, pp. 65-68; *Surveyor, 51* (1917), No. 131, pp. 298-300).—Further studies on the activated sludge process (E. S. R. 23 p. 888), including experiments on the effect of trade effluents on the process, are reported.

It was found "that, contrary to the opinion formed as the result of earlier experiments when working with a strong trade sewage, the maintenance of the activity of the sludge is not dependent on the stage to which nitrification is carried. When dealing with a sewage free from inhibitory trade effluents no appreciable loss of efficiency need be anticipated in this country (England) during the winter months. While the problem of disposal of the sludge remains to be fully developed, it would certainly appear from known data that the cost of dewatering and drying will be more than repaid by the value of the resultant dried sludge."

Sewage disposal for village and rural homes, C. S. NICHOLS (*Iowa Engin. Expt. Sta. Bul. 41* (1916), pp. 29, figs. 10, pls. 3).—It is the purpose of this bulletin to correct dangerous misconceptions recently published about septic tanks to point out the general principles covering the proper disposal of household

ates, and to illustrate some practical designs for sewage-disposal plants for instruction by the average householder which are the results of experiments at the engineering experiment station.

It is pointed out that "septic tanks are only water-tight cesspools provided with an overflow. . . . A septic tank is only a receiving tank for the sewage in which the solid material is settled out and allowed to remain for 'septic' (i. e. bacterial) action. Experience has shown that certain provisions as to location, slope, and structural details will facilitate the proper operation of such tanks, although septic action will take place in any receptacle which will retain sufficient liquid to cover the solid material and exclude light and air. . . . The liquid escaping from such tanks, whether through a tile overflow into a tight tank or through the porous soil or rock seams of a 'leaching' (i. e. water-tight) cesspool, is extremely foul, and is dangerous to life and health."

The two fundamental principles of sewage disposal are said to embody two distinct, supplementary, and equally necessary treatments, as follows: "(1) septic action, in a properly arranged, water-tight, covered, masonry tank for settling, retaining, and decomposing the solid material contained in the sewage; and (2) filtration and consequent oxidation and nitrification, by means of a properly arranged and maintained area of porous material through which effluent from the tank is filtered and subjected to bacterial action.

"In general, it may be said that only approximately one third of the necessary purification takes place in the tank. The degree of further purification will depend upon the type of filter chosen, its construction, care, and operation."

As a current breaker, it was found in the experiments that an ordinary 12 by 12 by 12 in., open at the top, bolted to the end of the wall of the tank, and receiving directly the downward discharge of the inlet pipe through a flange on the end, is effective. An upward sand filter at the outlet was found to minimize the passing on of sediment due to disturbance to the filter bed.

With reference to filters, "experimentation has shown that a bed of $\frac{1}{2}$ -in. stones, with ample provision for its aeration and the even distribution of sewage in small quantities over its surface will do good work and discharge effluent comparatively free from offensive materials. With such beds it is necessary that very special precautions be exercised to insure thorough aeration that the purifying agencies may have a constant supply of oxygen." Inter-tent sand filters are also discussed.

"The size of the dosing chamber is made such that the quantity of sewage discharged will flood the bed to a depth of only about $\frac{1}{2}$ in., this being repeated once two to four times during 24 hours."

Diagrammatic illustrations of three plants designed at the station are presented.

Designs for privies, R. MESSER (Amer. Jour. Pub. Health, 7 (1917), No. 2, pp. 159-196, figs. 5).—The author briefly describes and illustrates several well-known types of so-called sanitary privies and points out the advantages and disadvantages of each. It is believed "that some modification of the L. R. S. wet closet is the most satisfactory that has yet been suggested, and, furthermore, the additional expense of building is more than offset by permanency and small cost of maintenance. That the problem is far from being satisfactorily solved is clearly evident."

Hydroelectric power.—I, Hydraulic development and equipment; II, Electrical equipment and transmission, L. LYNDON (New York: McGraw-Hill Book Co., 1916, vols. 1, pp. VII+499, pl. 1, figs. 234; 2, pp. VII+360, figs. 241).—This work is in two volumes. It is the author's purpose "to produce

a work for the guidance of engineers in the practical design of hydroelectric plants which would have the characteristics of accuracy, clearness, and completeness. Scientific discussions of various hypotheses and theories have been omitted except in cases where their incorporation in the text has been essential to the understanding of the subjects treated. . . . A number of new and original formulas appear, for the first time, here. Among these may be mentioned the exact formulas for solid dams and for the magnitude and location of the resultants of forces acting on dams."

Volume 1 contains the following chapters: General conditions, flow in streams, weirs and orifices, power variation and storage, artificial waterways, pipes, lines and penstocks, dams, movable crests for dams, headworks, water wheel speed regulation of water wheels and abnormal penstock pressures, and a set of mathematical tables. Volume 2 contains the following chapters: Alternating current generators, transformers, switchboards, cranes, design and testing of power stations, fires and cables, insulators, pole and tower lines, electric circuits, calculation of transmission lines, deflection and mechanical stresses in transmission lines, line protection and accessories, and substations.

Methods and cost of screening and washing gravel for country road construction. A. A. McKAY (*Engin. and Contract.*, 47 (1917), No. 14, pp. 31-319).—This is a description of methods of obtaining gravel of extra good quality from low-grade gravel in Calhoun County, Mich.

Tests on corrugated metal culverts (*Technol. Expt. Sta. [Univ. Me.] Bul.* 2 (1916), No. 1, pp. 15, figs. 2).—Tests of the physical characteristics, crushing strengths, amount of zinc coating, and acid tests of 13 galvanized corrugated metal pipes are reported, the results being summarized in the following table.

Tests of corrugated metal pipes.

Type.	Weight per foot.	Gage.	Thickness, inches.	Character of assembly.	Crushing load per linear foot.	Zinc per square foot.	Acid test.
			Inches.		Pounds.	Ounces.	
Lap joint, riveted.....	10.7	51+	114	Good.....	4,800 good.....	2.10 O. K.....	High
Do.....	9.0	16	113	Good.....	3,870 fair.....	2.56 high.....	High
Do.....	9.7	16+	114	Good.....	4,470 good.....	1.62 O. K.....	High
Do.....	10.7	16+	121	Good.....	5,240 good.....	2.34 high.....	High
Do.....	7.0	18	11	Poor.....	3,280 fair.....	1.42 low.....	Low
Smooth bottom, bolted..	7.6	18+	10	Good.....	10,920 High.....	1.88 O. K.....	High
Do.....	8.1	18+	111	Good.....	5,410 good.....	1.84 O. K.....	High
Butt joint, clamped.....	10.0	16	12	Good.....	4,750 good.....	1.32 low.....	High
Do.....	9.0	16+	104	Good.....	4,750 good.....	1.90 O. K.....	High
Butt joint, wired.....	8.1	18+	111	Poor.....	3,120 fair.....	2.06 O. K.....	High
Do.....		16+				1.81 O. K.....	High
Butt joint, bolted flange.	10.8	17	121	Poor.....	1,800 poor.....	1.68 high.....	High
Do.....	10.4	16	121	Poor.....	1,670 poor.....		High

* Reinforced at one end.

† Failed on account of rivets pulling out.

‡ Failed soon because top was merely wired to bottom.

§ Loading slightly eccentric, hastening failure.

¶ Very scaly.

Public road mileage and revenues in the Central Mountain, and Pacific States, 1914 (*U. S. Dept. Agr. Bul.* 389 (1917), pp. 56+LXXV, fig. 1).—This report, prepared jointly by the Division of Road Economics of the Office of Public Roads and Rural Engineering and State collaborators, is a compilation showing mileage of improved and unimproved roads, sources and amounts of road revenues, and bonds issued and outstanding in the States of Arizona

California, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oregon, South Dakota, Utah, Washington, Wisconsin, and Wyoming. A description is also given of the systems of road administration, fiscal management, and other factors affecting road improvement in each State.

Public road mileage and revenues in the United States, 1914: A summary U. S. Dept. Agr. Bul. 390 (1917), pp. 11, fig. 1).—This is a summary, prepared by the Office of Public Roads and Rural Engineering and State collaborators and based upon Bulletins 386, 387, 388, and 389, showing for each State the total and surfaced mileage of public roads at the close of 1914, revenues from roads and bridges in 1914, State and local road and bridge bonds outstanding January 1, 1915, and other related data.

Maine State Highway Commission ([Augusta, Me.: State, 1915], pp. 1+29).—This pamphlet gives the texts of the laws of Maine relating to the laying out, construction, and maintenance of highways under the supervision of the State highway commission, including the law of the road. A section is devoted to an act to establish a State highway commission and to provide for an issue of State highway bonds.

Building a farm poultry house in northwestern Minnesota, C. E. BROWN *Minnesota Sta. Rpt. Crookston Substa., 1910-1916*, pp. 97-102, figs. 6).—This is a brief outline of the essentials of poultry-house construction for northern latitudes, including plans showing certain structural details.

Poultry management (*Minnesota Sta. Rpt. 1916*, pp. 78, 79).—A study of comparative values of glass and muslin screening in poultry-house construction showed that the average temperature was lower for the muslin front than for the glass front at 7 a. m., 1 p. m., and 7 p. m. Observations were made from January 12 to March 31, inclusive.

RURAL ECONOMICS.

Food supply of the United States, D. F. HOUSTON (U. S. Dept. Agr. Rpts. 116, pp. 10-13).—It is pointed out that within the period 1889-1915, inclusive, the population of the Nation has increased 26,000,000, or 33 per cent, and that, notwithstanding this very rapid increase in population, the per capita production of fish, cereals, potatoes, and vegetables has remained approximately the same, or has increased slightly. The per capita production of meat and dairy products, which constituted 37 per cent of the average diet, has not kept pace with the increase in population. The activities of the Department have been two important directions to increase the supply, that is, by checking and eliminating disease and parasites, and by increasing and improving stock raising by extending the industry where conditions are favorable and by pointing out the way to better breeding and feeding. With all the agencies now available for improving agriculture, there is said to be reason for optimism as to the ability of the Nation, not only to supply itself with food, but increasingly to meet the needs of the world.

Some fundamental considerations affecting the food supply of the United States, T. F. HUNT (*California Sta. Circ. 163* (1917), pp. 3-13, fig. 1).—On this memorandum prepared for the committee on resources and food supply of the State Council of Defense, the author points out that the Nation can not be served as long as there is an abundance of corn and cotton. It is not deemed advisable to attempt to control food production by legal or military means, nor admonition necessary to the farmer to grow materials so long as he understands which are likely, in the long run, to bring him the best returns for his

labor. Attention is called to the possible need of financing the farmer and co-operating with the labor supply.

Mobilization for food production, E. DAVENPORT (*Urbana: Univ. Ill., 1917*, pp. 4).—The author outlines a scheme to provide farm labor to increase the food supply through the enlistment of certain groups of men and boys for food production and their mobilization at training camp farms. He maintains that limiting the food of the people is wholly unnecessary if reasonable attention is given to the business of production and the present farm labor supply is adequately increased.

"Universal military service" for farmers, E. H. JENKINS (*Connecticut Sta. Bul. Inform. 7 (1917), pp. 4*).—The author maintains that the place for the farmer who has tillable land and expert knowledge and machinery to make it produce food is not in the training camp but in the field. He considers it better to fit and plant all of the land which it seems possible to handle, with the present expectation of summer help, at a risk of loss of part of the crop rather than through fear to plant only that which there is a certainty to be harvested.

The redistribution of the labor now employed in producing war supplies. H. H. LUND (*Amer. Econ. Rev., 7 (1917), No. 1, Sup., pp. 238-250*).—The author describes the methods used and results obtained by the Forward-to-the-Land League in placing city men on farms.

The land problem and rural welfare, P. L. VOGT (*Amer. Econ. Rev., 7 (1917), No. 1, Sup., pp. 91-101*).—"The most hopeful solution appears to be the control of tenantry through the exercise of the taxing power. If the tax were so adjusted as to give a strong inducement to the prospective absentee landlord to dispose of his land to the prospective tenant, much of the speculative holding of land would be quickly eliminated and prices of land to prospective purchasers would much more nearly equal their productive value. The inducement to transfer investment from land to other forms of property would work no great hardship to the owner, because under the rural credit law land mortgage bonds would be available as well as other types of securities the absentee ownership of which does not bring such serious difficulties in business management as does the absentee ownership of land."

Two dimensions of productivity, H. C. TAYLOR (*Amer. Econ. Rev., 7 (1917), No. 1, Sup., pp. 49-57*).—The author discusses the significance of capacity and efficiency as they relate to productivity, and the problem of land ownership on the part of the farmer. He illustrates his discussions by making comparisons of the results obtained by a study of 51 farms in Barron County, Wis., and the efficiency and capacity of a number of cows where detailed records have been kept.

Agriculture and the farming business, O. H. BENSON and G. H. BETTS (*Indianapolis: The Bobbs-Merrill Co., 1917, pp. [16]+778, figs. 263*).—This book attempts to bring together in one simple, nontechnical volume, the practical scientific information related directly to the every day problem of the farm and home. Among the topics studied are the organization of farm business, methods of growing and harvesting crops, types of soil, live stock, the farm house and its management, farm machinery, and education for farm life.

Profits in farming on irrigated areas in the Gallatin Valley, Mont., E. L. CURRIER (*Montana Sta. Bul. 111 (1916), pp. 52, fig. 2*).—This bulletin gives the results of a farm-management survey made during the summer of 1914.

It was found that the average farm labor income on the farms studied was \$555. As the amount of capital increased, the labor income increased correspondingly. Farms which had a large percentage of their capital tied up in

estate did not do so well as those that reserved an amount sufficient to adequately equip and operate their farms.

Farmers whose land was valued at \$100 an acre made better labor income in those with either higher or lower valuations. Farmers who sold a large percentage of their marketable crops had a better labor income than those who served a considerable portion for feed and seed, and farmers receiving a little more than one-third of their receipts from stock have a much better labor income than those who received either more or less from that source. The most favorable crop and stock relation seems to be attained on farms that have stock enough to utilize all cheap feeds and waste products but not so much as to have any considerable proportion of their feed to consist of products that are of high market value.

Tenants in this region receive a somewhat better labor income than do farm owners. The tenants are running a larger business and utilizing their land to their advantage than are those farmers that own their land. Tenants could improve their conditions by securing more and better live stock and owners could improve theirs by increasing the size of their business and using their land fuller capacity.

The Federal Farm Loan Act. C. W. THOMPSON (*Amer. Econ. Rev.*, 7 (1917), 1, Sup., pp. 115-131).—This paper discusses briefly the causes and steps leading up to the enactment of the Federal Farm Loan Act of 1916, the apparent intent of Congress in providing for two distinct farm mortgage bonding systems, provisions for safeguarding the proper granting of farm mortgage credit, means adopted for a form of security that will find ready access to the investment market, and the more important benefits that may be reasonably expected as a result of this system.

Report on the working of the cooperative societies in Bengal for the year 1915-16. J. M. MITRA (*Rpt. Work Coop. Socys. Bengal, 1915-16*, pp. 94-111).—This report continues the data previously noted (E. S. R., 35, 891), by adding data for a later year.

Agriculture in Oxfordshire. J. ORR (*Oxford, England: The Clarendon Press*, 6, pp. XII+239, pls. 29, figs. 11).—The author describes the types of farming carried on in the different regions in Oxfordshire, and discusses the administration of the land, the management of farm labor, soils, crops, and live stock. The book contains a chapter on soils by C. G. T. Morrison.

Crop condition and harvest field needs. (*Nebr. Dept. Labor Bul.* 33 (1916), 25, fig. 1).—This report contains data for the various counties in Nebraska, giving the acreage, average yield, total production of important crops, and demand for extra labor and wages during the previous year.

Agricultural statistics of British Guiana. J. B. HARRISON (*Rpt. Dept. Agr. and Agr. Brit. Guiana, 1915, Apr.-Dec.*, pp. 22-24).—This report continues data previously noted (E. S. R., 35, p. 795), adding statistics for a later year.

Return of prices of crops, live stock, and other Irish agricultural products. (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis, 1915*, pp. 38, pls. 16, figs. 1).—This report adds to that previously noted (E. S. R., 33, p. 894) data for 1915.

Agricultural statistics of Finland for 1910. (*Finland Off. Statis.*, III, No. 4, 1 (1916), pp. VI+327).—This report contains data showing by minor divisions the area cultivated and not cultivated, the area devoted to different agricultural purposes and to individual crops and pastures, the number of farms by sizes and tenure, and the distribution of land among different agricultural uses on farms by sizes, together with data relating to agricultural machinery.

Prices of cattle and meat in Russia, A. I. A. KORENBLIT (Kharkov. *Obshch. Nauch. Khoz., Oblast. Kom. Peresmotru Russ.-Germ. Torg, Dogov., No. 8 (1915), pp. 84*).—This report gives the monthly and yearly prices for 1908-1912 at Moscow and Petrograd for various classes of meat and cattle.

Live stock statistics [of Egypt, Spain, Morocco and Tunis] (*Internat. Inst. Agr. Rome, Internat. Crop Rpt. and Agr. Statist., 8 (1917), No. 3, pp. 185-185*).—These pages give the number of live stock, by classes, for 1916, with comparative data for earlier years.

AGRICULTURAL EDUCATION.

State higher educational institutions of Iowa (*U. S. Bur. Ed. Bul. 19 (1916), pp. 223, figs. 45*).—This is a report of a survey of the State higher educational institutions of Iowa, made under the direction of the U. S. Commissioner of Education for the Iowa State Board of Education. Among the findings of the survey committee summarized in recommendations are the following:

The adoption of the principle of "major and service lines of work" at the three State institutions; the creation of an annual conference consisting of members of faculties of the institutions and the State board of education, to adjust questions of overlapping not automatically determined by the establishment of major lines for each institution; the readjustment of the work in engineering at the State University of Iowa and the Iowa State College of Agriculture and Mechanic Arts, through a vertical division of work, assigning some branches of engineering to one institution and some to the other; the encouragement of the development of graduate work at the State university and agricultural college along the major lines of the institutions; the exercise of greater care by the graduate division of the agricultural college in admitting students from other institutions to graduate standing; the creation of a standing committee on graduate work to consist of members of the State board of education and of the institutions giving graduate work, the latter to be elected by the graduate faculties; the strict enforcement by the State board of education of the principle that departments of liberal arts and sciences at the agricultural college shall be simply service departments, especially the revision of the work offered in the departments of economic science, geology, physics, and mathematics, to conform to this principle; the abandonment of courses in chemistry at the agricultural college which neither contribute to the major lines of that institution nor reinforce the work of the experiment stations; the revision of the requirements for the degree of bachelor of science in the division of industrial science to render it impossible to secure the degree except on completion of industrial and professional courses (in contradistinction to liberal arts courses) equal in amount to those required in technical curricula; the strict application of the principle of the major lines of work to the development of the extension enterprises of the three State institutions; the establishment of a conference on extension work, composed of members of the board of education and extension officers of the three institutions, to discuss projects; the imposition of no external limitations upon facilities offered at the three institutions for giving work for the training of teachers in home economics, agriculture, and manual training until the present force of teachers in the State schools is equipped to meet the obligations imposed by the State law; but thereafter the delimitation of work in psychology and education at the agricultural college to the amount requisite to meet the requirements of the first-class State certificate; the development at the university of home economics as a service department, the establishment of special lines of work for the training

hospital dietitians, and the avoidance of courses that duplicate the work at the agricultural college in the preparation of high school teachers; the provision in the near future at the agricultural college of enlarged accommodations for the department of home economics, of opportunities for preparation in institutional and cafeterial management, and of special courses for the preparation of trade and industrial school teachers; the improvement of the accommodations provided for work in home economics at the State Teachers College, and the organization of the department under a single head; the abandonment of the agricultural college of noncollegiate work except for limited short winter, or summer courses for special groups of students and the establishment of corresponding work in selected high schools throughout the State under the direction of the agricultural college; the general reduction of the number of one and two hour courses, especially in elementary work and in the first half of the college year, and of the number of small classes of 10 or under; and the inclusion of the president of the agricultural college in the membership of a board of educational examiners and the inclusion of the presidents of the state higher institutions ex officio in the membership of the State board of education, without power to vote.

Agricultural education in the high schools and common schools of the state. L. S. HAWKINS (*N. Y. Dept. Agr. Bul. 81 (1916), pp. 1-44-1853, pls. 10*). The author briefly explains how the State of New York encourages agricultural instruction in its schools and gives a general description of the agricultural work, particularly the home project work, being done in the 61 high schools and 3 consolidated rural schools that have taken advantage of State aid for agricultural instruction.

Report of the director of elementary agricultural education for the province of British Columbia, 1914-15. J. W. GIBSON (*Ann. Rpt. Pub. Schools Brit. Columbia, 44 (1914-15), pp. A74-A85, pls. 4*).—This is the first annual report on elementary agricultural education in the Province of British Columbia. It deals with the author's view of agricultural education in the schools, summer schools in rural science for public and high school teachers, including outlines of courses, and with the organization of the first class in high-school agriculture and of an extension class in agriculture in connection therewith for young men not attending school.

Report of the director of elementary agricultural education for the province of British Columbia, 1915-16. J. W. GIBSON (*Ann. Rpt. Pub. Schools Brit. Columbia, 45 (1915-16), pp. A54-A71, pls. 10*).—This is a report on the story and development of agricultural teaching in British Columbia, progress of the school home gardening movement under the direction of the education department, school-ground improvement, agricultural instruction in high schools, fifth district supervision, including an outline of the two-year course of study for six months, and extension high school classes in agriculture for young men and boys over 15 years of age who are not in attendance at school. Plans of school gardens are included.

In 1915, of 100 schools with gardens, 80 qualified for the department grant. In these 80 schools the gardening work was conducted by 115 teachers with approximately 2,500 children. The total grant to the school boards on account of school garden expenditures in 1915 was \$4,052.11 and to teachers, as bonus grants, \$1,765.00. In 1916, 145 schools with gardens and 6,563 pupils took part in the work.

Special grants, regulations, and organization (*Dept. Ed. Alberta, Tech. d. Bul. 1, pp. 6*).—This bulletin contains the regulations pertaining to the payment of grants for instruction in science, agriculture, and school gardening.

manual training, household science and art, etc., and to the training and certification of teachers of these subjects.

For instruction in science, agriculture, and school gardening in rural and village school districts an annual grant is made to the school board equal to 50 per cent of its expenditure for approved improvements and maintenance of school gardens, and not exceeding \$15 for approved equipment, with an annual grant of \$25 to the teacher. In any school district including a town or city in which fewer than 30 teachers are employed in instruction in science, agriculture, and related school gardening in grades 7 to 11, inclusive, or all of such grades as may be represented in such schools, a similar grant of 50 per cent is made to the board, a maximum grant of \$75 for equipment, and \$50 to the teacher for full-time service. In a similar district in which at least 30 teachers are employed in the agricultural course of grade 11 the annual grant to the board is 50 per cent of its expenditure on approved improvements and maintenance of the necessary garden and experimental plots and for equipment, \$75.

The general direction of agricultural instruction, T. AMADEO (*Min. Agr. Argentina, Mem. Cong. Nac., 1914, pp. 91-101*).—This is a report on the object, work, equipment, and improvements of the agricultural schools and on extension activities in Argentina in 1914.

Agricultural and rural extension schools in Ireland, A. C. MONAHAN (*U. S. Bur. Ed. Bul. 41 (1916), pp. 38, pls. 10*).—This bulletin contains a brief account of the administration of public education in Ireland through the Commissioners of National Education, the Intermediate Board of Commissioners, and the Department of Agriculture and Technical Instruction for Ireland, together with information concerning the organization of the department and a brief outline of its activities. Descriptions of the principal types of agricultural schools are included.

In progression from the lower to the higher, there are for men three agricultural station schools or farm apprenticeship institutions and three other agricultural schools, the Albert Agricultural College, which is a farm-practice school giving a one-year course, and the Royal College of Science, with a four-year course, similar to the standard State colleges of agriculture in this country. For women there are nine rural schools of domestic science, the Munster Institute, the Ulster Dairy Institute, the Training School for Lace Teachers, and the Irish Training School of Domestic Economy for the training of teachers. Itinerant instruction in agriculture, through county instructors or agricultural agents, comprises schemes of instruction in poultry keeping and butter making, horticulture and bee keeping, and general instruction in farming in congested districts. There are also rural extension schools or winter classes in agriculture, and, for girls, in poultry keeping and butter making; and, through the division of technical instruction, rural extension schools in household arts, home industries, and farm carpentry.

Agricultural education and live stock improvement in Wales, 1913-1915, C. B. JONES (*Bd. Agr. and Fisheries [London], Rpt. Agr. Comr. Wales, 1913-1915, pp. 39*).—This is the report of the agricultural commissioner for Wales for the years 1912-13 to 1914-15. It deals mainly with the progress made in agricultural education, both in regard to the agricultural departments of the colleges and the farm institute scheme in the counties, and live-stock improvement. A summary of the report has been previously noted (*E. S. R., 36, p. 495*).

Report on the agricultural and housekeeping schools for 1914-15 (*Aarsber. Offentl. Foranst. Landbr. Fremme, 1915, II, pp. VIII+359*).—Detailed reports are given on the faculty, students, equipment, instruction, farm work,

and receipts and expenditures of the agricultural and housekeeping schools in Norway.

Report of the Department of Agriculture [of Finland] for 1914 (*Landtbr. Myr. Meddel. [Finland], No. 105 (1914), pp. 165*).—This is a comprehensive report on the activities of the department, through its education and research institutions, societies, and experts, for the advancement of Finnish agriculture.

Agricultural yearbook for 1917, edited by H. C. LARSEN (*Landökonom. Årbog [Copenhagen], 18 (1917), pp. 135*).—This is the annual directory of public institutions and associations for the advancement of Danish agriculture in its various branches. A list of periodicals published in Denmark is appended.

Bulletin relating to instruction in agriculture and gardening in elementary schools (*Edmonton, Alberta: Dept. Ed., pp. 125, pl. 1, figs. 30*).—This bulletin contains a schedule of grants to the school board and teacher for instruction in science, agriculture, and school gardening, an outline of the course in agriculture and gardening required in the seventh and eighth grades, and detailed suggestions to teachers regarding the method of teaching the subjects of soils and plants, including textbook work, practical exercises, and school and home gardening. Nature study and elementary gardening are required in grades 1 to 6, inclusive, in all schools, and agriculture is an examination subject in grade 11.

Course in agriculture for grade XI (*Edmonton, Alberta: Dept. Ed., 1915, pp. 94*).—This is an outline of a course in agriculture for grade 11 of the Alberta high schools, on which the 1916 examination was based.

Instructions to teachers and school boards with reference to school and home gardening (*Brit. Columbia Dept. Ed. Circ. 4 (rev. and enl.) (1917), pp. 151*). This circular contains instructions to teachers and school boards with reference to school and home-garden plans; projects involving experimental work in the variety and condition of seed, prevention of disease, selection, methods of sowing and cultivation, and fertilizers; supplementary home projects where pupils find it difficult or impossible to have home gardens; and competitions and care of school gardens during the summer holidays. A statement concerning grants to school boards toward approved school gardens and home gardening or related home projects, as well as teachers' bonus grants, is included.

Home and school gardening, J. E. McLARTY ET AL. (*Agr. Gaz. Canada, 4 (1917), No. 3, pp. 229-231, figs. 3*).—This is a series of articles on the relative educational value of school and home gardens, based on the experience with these two forms of gardens of the officials in charge of this work in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

In Prince Edward Island it is agreed that under ideal conditions the location of the garden at the school is the more satisfactory. However, the Department of Education is encouraging home gardens at least until a system of consolidated schools is established. In Nova Scotia school gardens are a failure, but home gardens are popular. In New Brunswick, Quebec, southern Saskatchewan, and Alberta it is found that classroom instruction, the observation, demonstration and investigation of the school garden (as the laboratory), and the home garden or project (the practical field) which is the natural outgrowth of these two features, are all necessary in an adequate plan for effective instruction in practical agriculture. In northern Saskatchewan the relative value of the two kinds of gardens has not been demonstrated, but the director of school agriculture is of the opinion that for the earlier grades, school gardening, and for the higher grades, a combination of school and home gardens

with the latter predominating in the final year, would appear almost ideal. In British Columbia the school garden is found to have important advantages over the home garden, but home gardening is deemed best suited to pupils of grades 7 and 8 or form 4. In other words, school gardening, which is more the broadly educational in its bearing, is the logical antecedent of home gardening, which is rather narrower in its scope and which as a rule makes larger demands upon the individual pupil.

Attention is called to the danger becoming apparent in Canada of regarding home gardening and related agricultural home projects as a preparation upon the part of pupils for the holding of a large and sensational school fair, the success of which is too apt to be estimated in the number of entries and the size of the crowd, whereas it should be only an incident in the year's work to arouse an interest among the people and the children themselves. Scores to be taken into consideration in awarding prizes at school fairs to overcome the tendency of making the winning of distinction the chief incentive of the work are also discussed.

School and home gardening for elementary schools in Oregon. M. O. EVANS, JR. (*Oreg. Agr. Col. Bul.* 176, pp. 23, figs. 22).—The author offers suggestions on the organization and cultivation of school and home gardens for elementary schools in Oregon.

Educative and economic possibilities of school-directed home gardening in Richmond, Ind. J. L. RANDALL (*U. S. Bur. Ed. Bul.* 6 (1917), pp. 25, pls. 4).—This bulletin contains a report of a study, made in cooperation with the Indiana vocational education survey, of the possibilities of home gardening directed by the public schools in the city of Richmond, Ind.

It is recommended that the Board of Education of Richmond establish a complete department of home gardening under the direction of the public schools within the next three years. The aims should be to train many people to produce their own vegetables and small fruit foods, and to carry out other avocational home projects which may have economic value to the people of the city. A vocational agricultural course should be given for high school students from the country and for those of the city who wish to take up farming as a life work. The course should be given by a teacher with theoretical and practical training in agriculture, who should be employed for twelve months and should also be the general home garden supervisor, giving one-half of his time to the high school work.

Supervised home project work. Z. M. SMITH (*Dept. Pub. Instr. [Ind.], Ed. Pubs., Bul.* 19 (1917), pp. 44, figs. 24).—This is a report on the project work in Indiana during the past year, including the larger purpose of this work, the income and profit, how the results were accomplished, and the value of close supervision and of county agents as supervisors. Suggestions are offered on organization for home project work and school credit for such work. A suggested list of projects, outlines of projects, a basis of awards for use in annual exhibit contests, and a list of references to literature for use in home project and club work are included.

Supplementary lessons in West Virginia agriculture (*Morgantown: W. Va. Univ.* [1916, pp. 157, figs. 35]).—This is a bound collection of all the boys' corn, potato, pig, and poultry club, and girls' tomato, strawberry, and raspberry club instruction sheets, accompanied by directions to teachers on the use of the sheets in making the instruction in agriculture in the rural schools of the State more practical and concrete. Suggestions for correlations with other school subjects are included.

Illustrated lecture on sweet potatoes: Culture and storage. H. M. CONOLLY (*U. S. Dept. Agr., States Relat. Serv. Syllabus 26 (1917), pp. 22*).—This syllabus deals with the raising of sweet potatoes, including a discussion of soils, rotations, propagation of plants, manures and fertilizers, preparation of the soil, planting, harvesting, storage, diseases, varieties, marketing, cost of production, and sweet potatoes as a feed for live stock. A list of 51 lantern slides to illustrate the syllabus is included.

Illustrated lecture on the farm vegetable garden. H. C. THOMPSON and H. M. CONOLLY (*U. S. Dept. Agr., States Relat. Serv. Syllabus 27 (1917), pp. 55*).—In this syllabus, prepared in cooperation with the Bureau of Plant Industry, the authors briefly discuss reasons for establishing a vegetable garden, its location, soil and plan, seed, methods of planting, establishing the garden, cultivation, irrigation, control of insects and diseases, special practices, etc. A list of 50 lantern slides to illustrate the syllabus is appended.

Agricultural arithmetic. G. C. SHUTTS and W. W. WEBB (*St. Paul, Minn.: Webb Publishing Co., 1916, pp. 255+10, figs. 54*).—Part 1 of this book is devoted to a review of the processes of arithmetic. Part 2 is an application of arithmetic to farm experiences, including problems dealing with farm crops and animals, feeds and feeding, the dairy, the soil, fertilizers, farm management and measurements, orchard and garden, household economy and human feeding, etc.

Illustrative fair exhibits. F. M. LUTTS (*Ohio Sta. [Pub.], 1917, Feb., pp. 27, figs. 27*).—This gives the earlier history of the illustrative fair exhibits of the Ohio Station; brief descriptions of the State fair exhibit and of the county fair exhibits, the latter representing nine station departments; information with reference to exhibit assignments, publicity, memorandum of understanding between the station and fair association, and the bill of material; and a summary of fair exhibit work in 1916.

MISCELLANEOUS.

Annual Reports of the Department of Agriculture, 1916 (*U. S. Dept. Agr. Rpts. 1916, pp. VI+451*).—This contains the reports of the Secretary and heads of bureaus and other administrative officers. The various reports are also issued as separates. Sections dealing with roundworms of sheep and the food supply of the United States are abstracted on pages 277 and 286 of this issue.

Twenty-ninth Annual Report of Illinois Station, 1916 (*Illinois Sta. Rpt. 1916, pp. 18*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1916, brief notes as to the principal lines of work, a note commemorative of the work of the late Dr. T. J. Burrill, and a list of the publications of the year.

Twenty-fourth Annual Report of Minnesota Station, 1916 (*Minnesota Sta. Rpt. 1916, pp. 83*).—This contains the organization list, a financial statement for the Federal funds for the fiscal year ended June 30, 1916, and for the State funds for the fiscal year ended July 31, 1916, and a report of the director summarizing the work of the station and its substations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of the superintendent, Northwest Experiment Station, 1910-1916 (*Minnesota Sta., Rpt. Crookston Substa., 1910-1916, pp. 102, pl. 1, figs. 14*).—This contains the organization list and a report of the superintendent of the

substation from 1911 to 1916, including several special articles by members of the staff. The experimental work reported is for the most part abstracted elsewhere in this issue.

Reports of Northeast Demonstration Farm and Experiment Station, Duluth, 1915 and 1916 (*Minnesota Sta., Rpts. Duluth Substa., 1915, pp. 11, fig. 1; 1916, pp. 12*).—These are reports of the work of the respective years. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of West Central substation, Morris, 1915 (*Minnesota Sta., Rpt. Morris Substa., 1915, pp. 15, figs. 3*).—This is a report of the work of the year. The experimental work with field crops is abstracted on page 229 of this issue.

Twenty-ninth Annual Report of New York Cornell Station, 1916 (*New York Cornell Sta. Rpt. 1916, pp. LXXXVII+832, pls. 41, figs. 145*).—This contains the organization list, reports of the director of the station and heads of departments, and reprints of Bulletins 362-377 and Circular 32, previously noted.

Report of the Porto Rico Insular Station, 1915-16 (*Rpt. Bd. Comrs. Agr. P. R., 5 (1915-16), pp. 101, pl. 1, figs. 3*).—This contains the organization list, a report by the director for the fiscal year 1915-16, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue. Analyses of soils are also included.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 2 (1917), No. 4, pp. 103-137, figs. 15*).—This contains several articles abstracted elsewhere in this issue, together with the following: *Post Timbers*, by J. J. Crumley, an abstract of Bulletin 219 (*E. S. R., 24, p. 644*); *Soil Bacteria*, by E. R. Allen; and notes.

NOTES.

Alabama Canebrake Station.—A canning demonstration was held at the station July 20, in cooperation with the State extension forces. The total attendance for the day was about two hundred.

Iowa College and Station.—George M. Turpin, head of the poultry section, resigned June 30 to engage in practical poultry work, and has been succeeded by H. A. Eitzenbender, formerly in extension work at the college.

Kansas Station.—A cooperative study to determine the value of sweet clover as a pasture crop for dairy cows has been begun by the departments of agronomy and dairy husbandry.

S. J. Pearce, a 1917 graduate of the University of Nebraska, began work July 1 at Herington as field dairy bacteriologist for the station in connection with a study in cream grading in progress at that point, in cooperation with the Dairy Division of the U. S. Department of Agriculture. M. W. Kirkpatrick, formerly superintendent of the Dodge City substation, has been appointed superintendent of the Tribune substation to succeed C. E. Cassel, resigned.

Minnesota University.—The university stock barn erected in 1884 was entirely destroyed by fire July 18, causing an estimated loss of about \$40,000. All live stock was saved, but a considerable amount of machinery and supplies was consumed. The cause is thought to have been a spark from a motor in the feed-mixing room.

Montana Station.—Ray S. Jones, assistant chemist, resigned May 1 to join the U. S. Officers Reserve Corps. He has been granted leave of absence until the end of the war.

Cornell University.—Dr. V. A. Moore, director of the New York State Veterinary College, has been appointed major in the Veterinary Corps of the U. S. Army.

New York State Station.—Substantial progress is being made in the construction of the new \$100,000 administration building, auditorium, and museum, although it is regarded as doubtful whether it will be ready for occupancy before the summer of 1918.

Irving Boase of Rochester and C. Fred Boshart of Lowville have been appointed to the board of control, vice Thomas Newbold and William H. Manning. J. F. Barker, agronomist, has resigned to accept a position in charge of extension work in agronomy at the Ohio State University, and will be succeeded by R. C. Collison, associate chemist, on September 1. Mr. Collison has also been granted a year's leave of absence for study, beginning with the next college year. W. W. Euer, assistant chemist, has entered the U. S. Naval Service.

Oregon College and Station.—A horticultural products building is being erected to aid in solving some of the many problems of food preservation confronting the department of horticulture. Many types of drying and canning equipment will be installed, including a modern evaporator of commercial capacity.

Dean A. B. Cordley has been elected chairman of the State Lime Board, which is to obtain lime for the use of farmers.

Porto Rico Federal Station.—The Porto Rico legislature, at its last session, appropriated \$1,000,000 for aid in the growing of food crops and an extension campaign is under way. About forty rural teachers are actively engaged in all sections of the island and a great many seeds of economic crops have been bought and distributed. Cane planters have been induced to plant or to allow their laborers to grow beans in the young cane, so that whereas last year over \$800,000 worth of beans was imported, beans have already been produced for export.

Rhode Island Station.—Howard A. Johns, a 1917 graduate of the Pennsylvania College, has been appointed assistant in chemistry beginning July 1.

South Carolina College and Station.—The animal husbandry and dairying division has been separated into divisions of dairying and animal husbandry. R. L. Shields continues as chief of the animal husbandry division and W. W. Fitzpatrick, dairy expert in extension work, has been appointed chief of the division of dairying.

G. M. Armstrong has been appointed instructor in botany in the college and assistant in the station. A new position of research assistant has been established in the division of horticulture.

Tennessee University.—H. D. Tate has been succeeded by W. A. Schoenfeld as assistant director of the division of extension, and he in turn by C. E. Brehm as specialist in marketing.

Utah College and Station.—Plans have been completed for the new dairy building and are under way for some new feeding sheds for experimental work with steers. Dr. C. E. Davis has resigned as assistant professor of chemistry to accept a position as research chemist with a commercial firm.

Virginia College and Station.—E. R. Hodgson, associate agronomist, has resigned to become specialist in agronomy in the extension division and has been succeeded by T. K. Wolfe, the assistant agronomist. G. S. Ralston has been appointed field horticulturist, to have charge of the several experimental orchards in the State.

Wyoming University and Station.—W. A. Albrecht, of the Missouri University and Station, has been appointed associate agronomist and acting head of the department of agronomy, beginning July 1.

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¹ Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

37.

NOVEMBER, 1917.

No. 7.

The thirty-first annual convention of the Association of American Agricultural Colleges and Experiment Stations, held in Washington, D. C., November 14-16, seems likely to be long remembered as one of the most interesting and inspiring in the history of the organization. As was pointed out by Secretary Houston in his address of greeting, according to the calendar barely a year had gone by since the previous meeting, but "judged by the experiences through which we have passed, it has seemed more like a generation." The profound changes during this period which the entrance of the Nation to the war has brought to every institution represented were reflected in the program, the point of view, and the predominating spirit of the convention.

Official delegates were in attendance from every State in the Union, as well as Porto Rico, and a delegation was also present from Canada which was given the privileges of the floor. From many institutions there were representatives for each of the five divisions of college, station, extension, engineering, and home economics work. The total registration of delegates and visitors aggregated three hundred and twenty, surpassing all previous records.

The large attendance was the more noteworthy since the number of other organizations meeting with the association was somewhat smaller than in 1916. Prior to the opening of the convention itself, a four-day conference was held of State leaders of home demonstration agents and the States Relations Service. The Society for the Promotion of Agricultural Science, the American Society of Agronomy, the National Potato Association, the American Association for the Advancement of Agricultural Teaching, the American Association of Farmers' Institute Workers, and the Association of Official Agricultural Chemists also held sessions before or after the convention. The attendance at many of these meetings was likewise unusually large, and while many of their papers followed the usual scientific and technical lines a distinctly war-time flavor permeated their programs and proceedings.

The program of the Association of American Agricultural Colleges and Experiment Stations naturally gave primary consideration to questions associated with the war and its relations to the land-grant institutions. The presidential address, for example, entitled *The Morrill Act Institutions and the New Epoch*. It considered some of the far-reaching changes which the war is bringing to the Nation, and the responsibilities and opportunities of these institutions not only during the conflict itself but in the era to follow.

In this address President Butterfield outlined some of the ideals of the democracy for which the Nation is contending, such as equality of opportunity, the exaltation of manhood and of the religious motive, and the substitution of cooperation for coercion. He indicated that the Nation would look to the agricultural colleges for their full share of leadership in bringing these ideals to realization. As he brought out, this will mean far more than the training of experts to increase production, important as this will continue to be. Its aim will be to develop leaders, men and women broadly educated and with vision and sympathetic understanding of what the new democracy will represent in rural life. As a preliminary step to meet the changing conditions, President Butterfield suggested the appointment of a national agricultural committee to consider the whole rural situation as affected by the war.

Practically an entire afternoon was devoted to a discussion of food and food administration, with addresses by Hon. Herbert C. Hoover, director of the Federal Food Administration; Prof. Isabel Bevier, of Illinois; Dean Catharine J. MacKay, of Iowa; and President C. R. Van Hise, of Wisconsin. The address of Secretary Houston, already referred to, discussed the season's work in food production and similar needs of the future. The experiment station section devoted its entire attention to this topic, with papers by Dr. Graham Lusk, entitled *Calories in Common Life*, this being mainly a discussion of the economic use of foods on the basis of their energy values, and a symposium on what the stations can most profitably do to increase the efficiency of food production and conservation in the present national emergency, participated in by Dr. Raymond Pearl, of Maine; Dr. E. W. Allen, of the Office of Experiment Stations; and others. From a somewhat different point of view the home-economics division took up the food-conservation program in a joint session with the conference of home-demonstration agents, Dr. A. E. Taylor, of the Food Administration, discussing the necessity and purpose of food conservation, and others, representing the Food Administration and the States Relations Service, describing the past summer's work and projected plans for the future.

An economic study of the farmer's income as affected by war conditions was presented at one of the general sessions by Prof. T. N. Fryer, of Harvard University, in which he considered in detail various items of income and outgo during the past season. Wide variations were found in the net profits accruing from different types of farming, ranging from losses on many dairy farms in the Northern States, where much grain is purchased, to profits somewhat higher than the average in sections where little or no fertilizer is required and the primary staple crops are marketed. The duty to the Nation at this time of conserving profits, however reasonable or legitimately acquired, was strongly emphasized.

Special mention should also be made of the stirring speech of President G. C. Creelman, of the Ontario Agricultural College, on Canada's part in the war. Some of the remarkable accomplishments of Canada, particularly that of materially increasing wheat production despite the wholesale withdrawal of labor to make up an army large in proportion to population as would be one of 5,000,000 men from the United States, were impressively narrated, and tribute paid to the substantial aid being rendered by the Canadian agricultural colleges and experiment stations.

The important service of the land-grant institutions in this country was attested by several speakers. Thus Secretary Houston declared that while at the time the country entered the war the Nation was not fully prepared for war in any respect "it was fortunately circumstanced in the character of its agricultural organization and the number and efficiency of its expert agencies. In fact, an efficient machinery for directing agricultural activity as represented by the land-grant colleges, the Federal Department of Agriculture, farmers' organizations, and its alert and patriotic rural population, it excelled any other two or three nations in the world combined."

"The Nation may well pride itself," he said, "on the fact that it had had the foresight generations ago to lay deep its agricultural foundations." He congratulated the representatives of the land-grant colleges on the fine opportunity for service presented to them and on the splendid way in which they had seized it. "The Department of Agriculture has had great comfort in the thought that these institutions, ably planned and wisely directed, existed in every part of the Nation and stood ready not only to place themselves at the service of the National Government but also to take the initiative in a vast number of directions."

Similarly, President E. C. Perisho, of South Dakota, in a paper before the college section on The Best Things Done by the Land-

grant Colleges to Meet the War Emergencies of the Nation, maintained that "no portion of our people responded more quickly or more intelligently than did the men and women of the land-grant colleges. From every one of these institutions there was sent at once to State and Federal authorities not only assurance of loyalty but the free offer of men, military departments, laboratories, machine shops, experiment plats, engineering plants, agricultural workers, and the entire staff of our extension divisions." This service took the form of cooperation with State and Federal governments, assistance in the production and conservation of food materials, the work of the extension divisions and experiment stations, aid rendered along military lines, the offering of special emergency courses, and many forms of individual aid by students, faculty, and alumni.

Appreciation of the part played by the land-grant institutions along military lines was voiced by Major Clark, representing the Adjutant-General's Office of the War Department, who specially commended the work of the men entering the officers' training camps; and by President James of the University of Illinois, who drew attention to some of the potentialities of these institutions as military assets. Maj. David S. White, of the Veterinary Corps of the U. S. Army, in a discussion of the organization and workings of this branch of the service, indicated the substantial aid rendered by many institutions in supplying competent veterinarians.

Interest in past achievements of the colleges and stations, however, was far overshadowed by the evidence of their desire to serve the Nation in the most effective way possible in its present and future needs. The program was, therefore, constructive rather than reminiscent, and dealt quite largely with ways and means for immediate application. For example, in addition to papers already referred to, President Soule, of Georgia, took up in the college section the question of how the land-grant colleges may be organized to serve the Government in the war emergency, and the engineering and home economics divisions considered modifications in their respective curricula to meet the emergency conditions.

As would be expected, special interest centered in the developments along the line of extension work. The Federal program for extension work during the war period was outlined by Dr. A. C. True. The program suggested for the agricultural colleges and the Department of Agriculture included as its principal items the full maintenance of the food supply and its conservation, the preservation of a permanent and safe system of agriculture, the rendering of assistance in the solution of such problems as farm labor and the handling and marketing of farm products, and assisting the Federal Government in spe-

ial work from time to time. Some of these phases were discussed by others in considerable detail.

For instance, President Pearson, of Iowa, took up the cooperation of the extension service with State councils of defense and other public and private organizations. Vice-director M. C. Burritt, of New York, and Director John T. Caine, of Utah, discussed forms of organization required in the county before funds are available for the employment of emergency food agents; and Director C. A. Keffer, of Tennessee, and Miss Florence E. Ward, of the States Relations Service, described the correlation of men and women agents. Under the general subject of Methods of Meeting the Farm Labor Shortage, Director C. W. Pugsley, of Nebraska, discussed the Organization of Farm Labor Bureaus, and Director William D. Hurd, of Massachusetts, the Utilization of Nonproductive or Partially Nonproductive Labor, such as the boys' working reserve and similar agencies.

An important problem as regards extension publications was referred to in the report of the bibliographer, which dealt with agricultural literature and the war. The vitally significant change in the character of this literature during the year has been, as Dr. True stated, the tremendous output of popular emergency material of a new sort, "exhortation and precept cast into pictorial, mimeographed, or printed form, bulletins, posters, circular letters, and what not." This material has been distinguished alike "by its needless variety in form of presentation and its endless repetition of subject matter."

Much of the duplication has been of course unavoidable under the circumstances, but as Dr. True maintained, "the situation no longer justifies the same degree of duplication of effort or breathless haste of issue and distribution. It is now possible to foresee, for a sufficiently extended period, the subjects which will claim attention, and it will, therefore, be possible carefully and thoughtfully to plan for the advantageous use of existing and available material, as well as for the preparation of such new matter as may be needed. The variety in form and subject of what has been issued gives ample opportunity for matured, well-considered selection of suitable forms of presentation, and will be valuable as a guide to the formulation of more definite principles by which future activities may be guided."

The discussion of the part which the experiment stations should play in the war program has already been referred to. Interest in this topic was decidedly keen, and the strong desire of station workers to bring their work into close relations with the emergency conditions was much in evidence. It was recognized that the fundamental character of the stations as research institutions must be

preserved, but there was general concurrence in the view expressed that "the emergency presents special reason for some degree of temporary adaptation and less rigid adherence to strict limitations and the pursuit of established projects than under normal conditions."

Numerous specific suggestions were made as to how this redirection of effort could be accomplished. The situation may be summarized by the following quotation from one of the addresses: "The experiment stations can be of the greatest service at this time by continuing to serve in the capacity of experts in agricultural science and its interpretation, by supplying tested and reliable information and making this available and applicable, by expanding study of the general situation in its relation to agricultural production, by supplying counsel and formulating broad plans and policies, by being alert to detect and act upon the present necessities, and by exercising foresight in preparing for post-bellum conditions. They can do this—

"(1) By letting their work be known—by seeing to it that it is written up and published promptly.

"(2) By maintaining unusually close relations with the public and teaching agencies, seconding the efforts of the extension and other agencies in helping and protecting the producer.

"(3) By a revision of their project programs, selecting for special attention those having an emergency or present importance, and by adapting others so as to take account of the changed conditions resulting from the war.

"(4) By working close to the ground, reaching out into the State and maintaining an unusually close contact with the actual conditions of production.

"(5) By inaugurating, to a limited extent naturally, new investigations having war-time and post-bellum significance.

"(6) By working close together, either in cooperation or with mutual understanding, and at least with full recognition of other similar work, in order that greater accuracy may be attained and time economized."

Aside from war questions the convention had before it a number of other important matters. A development of the year which received special consideration was the enactment of the Federal Vocational Education Aid Act. Although this measure, as is well known, deals with instruction of subcollegiate grade and makes no direct reference to the land-grant institutions in its scheme of administration, its workings are none the less of great interest to them. One of the general sessions was largely devoted to this subject, and it

dition a round-table conference was held by the home economics division on the training of teachers in that subject. The topic likewise assumed great prominence in the meetings of the Association for the Advancement of Agricultural Teaching, with addresses by a member of the Federal Board for Vocational Education and several others of the staff.

At the general session of the association, some of the policies and plans of the Federal Board were outlined by Mr. Charles A. Prosser, director of vocational education, while some requisites in the training of teachers under the act were discussed for agriculture, the trades and industries, and home economics by the assistant directors for each of these subjects. Dean Alfred Vivian, chairman of the State Board of Education of Ohio, closed the discussion as spokesman from the lay point of view of the association and the State boards.

The address of Mr. Prosser drew attention to the large measure of authority given under the act to the State boards of vocational education in correlating the new system with the work of existing institutions, but he expressed the opinion that the land grant colleges could render very useful service. The greatest needs in developing vocational education he considered to be intelligent supervision and a competent teaching force, and he maintained that the colleges, with their unique advantages as sources of subject matter, possess a special opportunity for developing strong courses to meet these needs.

A similar view as to the opportunity and duty of the agricultural colleges in teacher training was taken by the standing committee on instruction in agriculture in its report on college teaching in agriculture, with particular reference to the improvement of methods. In this report the committee expressed the view that "strong departments of agricultural education will be needed under the administration of the Smith-Hughes Act in order to give the colleges of agriculture the positions they should occupy in the training of teachers of agriculture. Unless these colleges take up the teacher training work actively at the present time, the funds provided for this work under the Smith-Hughes Act are likely in many States to be divided among a number of institutions, including some of relatively low grade and poor equipment, with the result that our whole system for training teachers of agriculture will be fundamentally weak. The agricultural colleges ought to have a clear leadership in this field, and they can not have this unless they adequately equip their departments of agricultural education."

The committee also urged the development of such departments as a means of improvement of college teaching in general. It was

recognized that in the past a large proportion of college graduates without special pedagogical training have done well as teachers, in "they have succeeded in spite of the lack of professional training and the percentage and degree of successes might have been much larger if the professional training had been provided. No matter how well manned and equipped the subject matter departments of the colleges of agriculture may be, they need the help of strong departments of agricultural education, not only in the training of undergraduates for teaching positions but also in improving the quality of teaching within the subject matter departments."

Two other papers of direct interest to educators were presented. One of these was a study of the prevailing requirements for graduation in agriculture in the land-grant colleges, presented before the college section by Dr. C. D. Jarvis of the U. S. Bureau of Education. The second was a discussion of the status of agricultural engineering instruction in the land-grant colleges, by Dean Stout of Nebraska.

In Dr. Jarvis' study, a decided increase was noted in the entrance requirements for college work in agriculture within recent years coupled with greater uniformity among institutions and considerable optional substitution of vocational for academic subjects. Much difficulty was found, however, in comparing the requirements for graduation, mainly because of the diversity of practice as to units of credit. Wide variations were also encountered in subject matter, distribution by courses, proportion and kind of prescribed and elective work, and similar matters. The study made it apparent that there is still much difference of opinion as to the optimum college course in agriculture, although the discussion following its presentation indicated general agreement on the part of those present that as much uniformity should be obtained as would be feasible under varying conditions.

The report of the committee on college organization and policy was in two sections. The first section dealt with administrative organization, presenting fourteen recommendations for consideration. Under the plan proposed, the individual specialist capable of working independently is regarded as the unit of organization. A subject matter department would consist of the group of working specialists on that subject, regardless of the kind of service, and authority for subject matter would be confined to this group of specialists, administrative control being limited to the amount and method of work. Administrative authority would be on the basis of kind of service, with the various kinds coordinated under a chief executive.

The remaining section of the committee's report, and likewise the report of the committee on extension organization and policy, dealt largely with the relations of the colleges to other agencies, such as

Federal Board of Vocational Education, the Food Administration, and the emergency and other work of this Department. The native committee of the association was instructed to represent the interests of the association in these matters. A request from the legal committee that the executive committee report on the feasibility of the preparation of a history of the Morrill Acts and supplementary legislation was also adopted.

The committee on graduate study discussed the status of the Abrate School of Agriculture under the emergency conditions. In view of the altered situation it advised the postponement for another year of a decision as to continuing the school. This recommendation was accepted by the association.

The familiar question of the form and content of station publications was discussed from various points of view. A comprehensive report was submitted by the committee on experiment station organization and policy, which drew attention to the prevailing diversity of practice. More than a score of existing series of publications were mentioned, and it was stated that many of the individual series may be "one thing at one station or at one time, but another thing at a different place and time."

To relieve some of the existing confusion, the committee suggested a series of publications as covering the usual needs. These include, besides technical papers published in scientific journals, regular bulletins designated as bulletins, research bulletins, regulatory bulletins, circulars, and the annual report. Of these the bulletins are for the general reader, and devoted primarily to the publication of the results of the station's own work as appear to be important or especially useful or interesting to the serious student of practical agriculture, especially the farmer. Technical material should be given special distribution, either by publication in scientific journals or in regular or research bulletins, issued in limited editions. Circulars when deemed necessary would include, not the popular information largely disseminated through extension series, but popular accounts of small pieces of work, matter too ephemeral in nature to bear in the bulletin series, preliminary announcements, popular editions of bulletins, and similar material. The annual report is regarded as an administrative document, and designed to be an accurate and permanent record of the station's progress during the year.

As to subject matter, the thesis was laid down that, "the publications of an experiment station properly consist of accounts and records of its experiments and investigations and of their applications, leaving to other agencies the dissemination of general information and experience, propaganda, descriptions of farm devices,

methods in farming, etc." The committee also pointed out that a scheme for publishing will require some supervision, and suggest the desirability for providing in connection with the director's office some machinery for assuring systematic attention to manuscript matter in course of publication.

A report on publications from a committee of the Agricultural Libraries section of the American Library Association was also received, and is to be included in the proceedings of the association. This report dealt more specifically with the details of distributing the publications among libraries, and their most effective utilization.

Still another phase of the subject was touched upon in the report of the association's committee on the publication of research, which again indicated very clearly some of the advantages accruing from the use of the *Journal of Agricultural Research* as a medium of publication. It was stated that of the one hundred and eleven papers appearing in the journal during the past year, fifty-seven were by station workers, representing twenty-four institutions.

The proposed initiation of Federal aid to research in engineering was again considered by the engineering section, and a comprehensive measure submitted by a committee of that section was subsequently approved by the association itself. This measure would provide \$15,000 per annum of Federal funds to each State and Territory for engineering experimentation at the land-grant college, but would involve an equal appropriation by the States for similar work to be conducted either at the same institution or elsewhere as determined by the legislature. The executive committee was instructed to give the consideration of legislation along these lines as a war measure.

The election of officers resulted in the selection of Dean Earl Davenport of Illinois as president; President C. A. Lory of Colorado, President A. M. Soule of Georgia, Director J. G. Lipman of New Jersey, President A. F. Woods of Maryland, and Dean R. S. Thatcher of Minnesota, vice presidents; and the reelection of the previous secretary-treasurer and bibliographer. The membership of the various committees underwent few changes. The vacancies caused by the retirement from land-grant college work of Presidents Ward of Kansas and Duniway of Wyoming were filled respectively by the appointment of Prof. G. A. Works of Cornell University to the committee on instruction in agriculture and President C. A. Lory of Colorado to the committee on college organization and policy. President W. M. Riggs of South Carolina succeeded President Waters on the executive committee, the personnel of which was otherwise continued unchanged. An amendment to the constitution proposing the enlargement of the executive committee to six members

additional member to be selected by the extension section, was held for consideration at the next annual meeting.

Section officers included for college work and administration, Agent E. C. Perisho, of South Dakota, chairman, and President J. Hetzel, of New Hampshire, secretary; in the station section, W. M. Jardine, of Kansas, chairman, Director W. P. Brooks, Massachusetts, secretary, and Mr. W. H. Beal, of the States Relations Service, recording secretary; and in the extension section, Mr. C. R. Tidlow, of West Virginia, chairman, Dean E. C. Son, of Kansas, secretary, and Mr. Bradford Knapp, of the Relations Service, recording secretary. The engineering division elected President W. M. Riggs, of South Carolina, chairman, Dean A. A. Potter, of Kansas, secretary; and the home economy, Miss Isabel Bevier, of Illinois, chairman, and Miss Mary May, of Kentucky, secretary.

The 1917 convention was thus an unusually interesting gathering, different in many respects from any which had preceded it. It felt how closely the war has been brought home to the land-institutions, depleting the faculty and student body, interrupting many well established projects, and compelling a redirecting of the entire program and point of view. More strongly, however, it indicated how largely the Nation is relying on these institutions in present emergency, and how important are the functions which theirs to fulfill. It put this great body of public service institutions, already conspicuous for a season's successful endeavor, forward on record as enlisted for the war, and with their full resources directed in the national service.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Isolation of cyanuric acid from soil, L. E. WISE and E. H. WALTERS (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 2, pp. 85-92, pl. 1).—The authors note the isolation of a nitrogenous compound from an Indiana soil of identical identity with cyanuric acid prepared by heating urea with zinc chloride established. The largest amount of the acid isolated from any of several soils was 23 kg. of the Indiana soil was about 0.15 gm. Cyanuric acid was isolated from a Maine soil, 46 kg. of soil yielding about 0.165 gm. of acid. Florida soil, yielding approximately 0.04 gm. of acid from 23 kg. of soil. Texas soil, which yielded about 0.04 gm. from 46 kg. of soil.

The procedure used in the isolation of the acid from the soil samples and the identification tests are described in detail. The possibility of the formation of cyanuric acid in the soil by the decomposition of nucleoprotein or other bases, some of which have been previously isolated, and its possible derivation from urea are suggested.

Analysis of ragweed pollen, F. W. HEYL (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 7, pp. 1470-1476).—The following percentage composition is reported for the pollen of the ragweed (*Ambrosia artemisiifolia*): Alcohol-soluble matter, 42.9; moisture, 5.3; crude fiber, 12.2; pentosans, 7.3; ash, 5.4; dextrin, 24.1; protein, 24.4. Of the protein about 7.5 per cent could not be extracted with water. 6.75 per cent was extracted with dilute alkali and only about 5 per cent with 10 per cent salt solution. The albumin and globulin fractions thus appear to be small. The presence of proteases is indicated. The alcoholic extract was found to have the following percentage composition: Fat, 10.8; lecithin, 0.75; ether-soluble (but not soluble in ligroin), 1.75; sucrose, 0.4; glucose, 1.6; resin, 15.4 and a nitrogenous base.

Some opthalmitic tests obtained in the case of two hay-fever subjects are noted.

The pungent principles of ginger.—I, A new ketone, zingiberone, occurs in ginger, H. NOMURA (*Sci. Rpts. Tohoku Imp. Univ.*, ser. 1, 6 (1917), No. 1, pp. 41-52).—The author notes the isolation from ginger of a ketone, zingiberone, having the composition $C_{15}H_{24}O_6$. The experimental procedures used in the isolation and the determination of its chemical constitution are described in detail.

Gingerol and paradol, E. K. NELSON (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 7, pp. 1466-1469).

Microorganisms and heat production in silage fermentation, O. W. HUXE (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 2, pp. 75-83, figs. 16-17).—In the study reported by the author at the Kansas Experiment Station an endeavor was made to determine the exact cause of heat production in silage fermentation. Alfalfa, corn, cane, and Kafir corn forage, siloed under laboratory conditions, were used for silage production. Heat production was observed in normal fermenting forage, forage treated with a weak antiseptic, forage

ated with heat, heated forage inoculated with bacteria, and cured or dried forage. Normal check fermentations were provided by silaging untreated forage. The untreated and inoculated forage all showed a marked increase in acid production, while the chloroformed and heated samples exhibited no increase. Good clean-flavored silage resulted in every instance from the fermentation of untreated, green, cured, and inoculated forage. The treated forage, that treated with chloroform and that heated, exhibited no characteristics of acid. Heat production was observed only in the untreated and inoculated forage, with no indication of heating in any of the treated samples. The heat production of the different kinds of silage is represented in graphical charts. From the investigation it is concluded that "heat production in forage fermentation results from microbial activity and not from intramolecular respiration of the tissue cells."

The citric acid fermentation of *Aspergillus niger*, J. N. CURRIE (*Jour. Biol. Chem.* 31 (1917), No. 1, pp. 15-37, pls. 2, figs. 2).—The author has studied the general salt requirements, the general equation of metabolism, and the reaction of the medium of the citric acid fermentation of *A. niger*. From observations of a large number of cultures, iron is not considered necessary for the development of spores. It is suggested, however, that some definite chemical action involved in the utilization of nitrates is accelerated in the presence of iron.

The fermentation of a sugar by *A. niger* is considered an oxidation proceeding through three stages and producing citric acid, oxalic acid, and carbon dioxide. The portion in which the products of the metabolism appear can be varied at will. Quite different results are given by cultures, even under the same conditions, which can not be distinguished morphologically. By proper selection of times and conditions the yield of citric acid can be varied from none at all to over 50 per cent of the sugar consumed. Low nitrogen supply, high concentration of sugar, and nitrogen supplied as ammonium salts rather than as nitrates are conditions especially favorable to the fermentation. Where the nitrogen was supplied as ammonium salts or as asparagin, iron was not found to stimulate the metabolic processes in any way. In the case of nitrates the stimulating effect of iron, however, was especially noticeable in the increased production of carbon dioxide and weight of mycelium.

From the general consideration of the data obtained the following medium is considered the most suitable for conducting the citric acid fermentation with sugar: Per 1,000 cc. of solution, saccharose 125 to 150 gm., NH_4NO_3 2 to 2.5 gm., KH_2PO_4 0.75 to 1 gm., $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ 0.2 to 0.25 gm., HCl to pH 3.4-3.5 (4 cc. fifth-normal).

Influence of certain electrolytes upon the course of the hydrolysis of starch by malt amylase, H. C. SHERMAN and JENNIE A. WALKER (*Jour. Amer. Chem. Soc.* (1917), No. 7, pp. 1476-1493, figs. 7).—The rate of formation of reducing sugar by the action of purified malt amylase on soluble starch, both in dry solution and in solution with the addition of regulated amounts of hydrochloric or phosphoric acids or primary potassium phosphate, was investigated.

When the activating electrolyte was added in such amount as to give optimum or nearly optimum concentration of hydrogen ion, the action of the enzyme was increased not only in the earlier stages but throughout the entire time investigated. The greater the concentration of enzyme the less the effect of the added electrolyte. . . . Throughout the first half of the hydrolysis, or up to half of half the theoretical amount of maltose, the rate of maltose formation from soluble starch was found to be proportional to the concentration of substrate, at least in solutions containing favorable amounts of acid or acid

phosphate. When, in similar experiments, enzym concentration is varied within limits suitable for such quantitative study, the rate of maltose formation is found to be directly proportional to the enzym concentration up to a point, about half the theoretical amount of maltose. This broadens the range within which diastatic activities may be compared quantitatively."

No "region of linear relationship" in which the yield of reducing sugar is directly proportional to the time was found. No cessation of hydrolysis at true equilibrium at 80 per cent was shown in experiments with widely varying enzym concentration, as was claimed by some previous investigators.

A noteworthy effect of bromids upon the action of malt amylase, by THOMAS (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 7, pp. 1501-1503, fig. 1), in an investigation on the activation of malt amylase by acids and salts, was observed that bromids when present in small amounts exercised an inhibiting effect on the action, but an activating action was observed when the concentration of the salt was increased. As previously shown, the chlorid, nitrate, phosphate, and phosphate of sodium and potassium activated malt amylase proportionately to the concentration of the salt present. The experiments were repeated with sodium and potassium bromid which had been recrystallized several times, positive results being obtained.

Experimental data are submitted in tabular and graphical form.

A handbook of organic analysis, H. T. CLARKE (*London: Edward Arnold*, 1916, 2. ed., pp. VIII+264, figs. 23).—The subject is treated under the topics: preliminary investigation, examination for radicals, separation of organic compounds, quantitative determination of constituent elements, quantitative determination of radicals, and determination of some physical properties.

Classified tables which give the melting or boiling points and common reactions of the more common organic compounds are included. A detailed index of the tables is appended.

A titration flask, F. K. BEZZENBERGER (*Jour. Amer. Chem. Soc.*, 39 (1917) No. 7, p. 1521, fig. 1).—A titrating flask, to be used in place of the well-known burette, which has been found to possess some advantages in volumetric analysis is described.

The estimation of sulphur in plant material and soil, G. A. OSBORN (*Washington Sta. Bul.* 145 (1917), pp. 3-12, figs. 2).—Tabular analytical data relative to the sulphur content of linseed meal, corn, peas, beans, wheat, casahuate, and gluten obtained by the Parr bomb calorimeter method and compared with the official and Osborne methods show that with certain precautions the latter method can be successfully used without sacrificing any degree of accuracy for speed. The material should be very finely ground, the silica removed, and the precipitate of barium sulphate well washed.

For the determination of sulphur in plant materials a charge of 0.657 gm. was found to be the most satisfactory. The fusion mixture used was the same as that recommended by Parr, except that sodium nitrate was substituted for potassium nitrate because of the tendency of potassium salts to form double salts with barium. The mixture consisted of boric acid 5, sodium nitrate 1, and magnesium metal 1 parts by weight. The exact amount of sodium peroxide necessary was found to vary with the nature of the material, approximately 16 gm. being necessary for gluten and similar nitrogenous substances, while for starchy substances, such as flour, etc., from 12 to 14 gm. was found sufficient. Shortening of the electrodes about $\frac{1}{4}$ in. in the Parr bomb apparatus was found to be more satisfactory with the quantity of material used in the charges. A bomb having a bottom cast in one piece with the shell is considered preferable to one with a removable bottom.

for the determination of sulphur in soil a 2-gm. charge with 1 gm. of fusion flux was used. In addition 0.5 gm. of sugar was added and from 10 to 12 cc. of sodium peroxid. Some slight precautions were found necessary in the application of the method to sulphur determination in soil. The method as given is described in detail.

The successful use of the bomb method for the determination of phosphoric acid is noted, but because of the easier manipulation of other procedures it is considered desirable.

The influence of the presence of calcium carbonate on the determination of available phosphoric acid in soils by Dyer's method, JATINDRA NATH SEN *Indian Jour. India*, 12 (1917), No. 2, pp. 258-265.—Some experimental data on effect of large amounts of calcium carbonate in soils on the amount of phosphoric acid extracted by treatment with 1 per cent citric acid are submitted and discussed. Other factors which might affect the rate of solution, such as fineness of soil, composition, etc., are also discussed.

The retarding influence of calcium carbonate was considered not to be due to neutralization of citric acid, since the fall in the amount of phosphoric acid extracted was maintained up to a calcium carbonate content of 4 per cent when only 7.1 gm. of calcium carbonate was required to neutralize the citric acid used in the extraction. It thus appears that the phosphoric acid is actually absorbed or "fixed" from the solution by the calcium carbonate.

For phosphoric acid determination in phosphate rock, C. C. SEMPLE (*Engin. Min. Jour.*, 193 (1917), No. 26, pp. 1140, 1141).—On account of the difficulty of using molybdic acid the following procedure was devised for the determination of phosphoric acid in phosphate rock:

A 0.5 gm. sample of material containing 20 per cent or more phosphoric acid (a proportionate sample of material containing less) is treated in a 75-cc. beaker with 10 cc. concentrated nitric acid and stirred until all the material is dissolved and effervescence ceases. Twenty cc. of concentrated hydrochloric acid is then added and the material gently boiled on the hot plate. If soluble silicates are present they should be dehydrated by evaporating the material to dryness several times with concentrated hydrochloric acid.

The material is finally taken up with 10 cc. concentrated hydrochloric acid and boiled for a few minutes to dissolve all soluble salts. Boiling water is then added and the material allowed to set until the residue settles, after which the liquid portion is decanted on a filter and the filtrate received in a 300-cc. beaker. The residue in the casserole is again treated with concentrated hydrochloric acid and hot water, and finally transferred to the filter and washed with boiling water until the bulk of the filtrate is about 175 to 200 cc.

Ammonium hydroxide, a little at a time, is then added to the filtrate until the turbid precipitate of calcium, iron, and aluminum phosphates begins to form, after which 30 cc. of ammonium hydroxide (specific gravity 0.9) is added and the liquid well stirred. Ten cc. of a saturated solution of citric acid is added and the solution stirred for two minutes. Enough citric acid should be added to insure complete solution of all the precipitated phosphates.

Forty cc. of magnesium mixture is added and the beaker set aside to allow precipitation. It is indicated that, although complete precipitation has been effected in 1.5 hours, it is advisable to allow at least 3 hours and to keep the beaker for 24 hours to be certain that complete precipitation has taken place. After complete precipitation the liquid is decanted, the precipitate finally collected on a filter, and washed with the usual wash solution, consisting of ammonium hydroxide and ammonium nitrate. The filter and precipitate are then dried in a crucible, dried, ignited, and weighed as magnesium pyrophosphate.

Comparative analytical data with the molybdate method indicate the accuracy of the procedure.

Approximate results may be obtained at the time of adding the citric acid, since the amount of acid required is proportionate to the amount of phosphate present. A solution of citric acid standardized against a known sample is added to the solution containing the precipitates until it just clears. Results within from 0.5 to 1 per cent of those obtained by the regular procedure are secured.

For the determination of lime in a complete analysis of phosphate rock, the following procedure is proposed: A 0.5-gm. sample is treated in the same manner as in the phosphoric acid determination. The acid is entirely boiled off and the residue dehydrated. Hydrochloric acid is again added and the material heated to dryness. Fifteen cc. of concentrated hydrochloric acid is finally added, the material boiled, after which 50 cc. of boiling water is added and the material filtered and washed.

Since iron can not be separated from the filtrate by the addition of ammonia, because of the precipitation of calcium phosphate, ammonia is added until the precipitate begins to appear, and then hydrochloric acid, drop by drop, until the filtrate is clear again. Two cc. of hydrochloric acid is added in excess, the liquid heated to boiling, and 5 gm. of crystallized oxalic acid added, and, after 5 to 10 to 40 cc. of boiling saturated solution of ammonium oxalate. After boiling 10 to 15 minutes the precipitate is filtered, washed, ignited, and weighed as calcium oxalate in sulphuric acid and titrated with standard permanganate. The presence of the free oxalic acid keeps the iron in solution.

The use of fused quartz and alundum crucibles in place of platinum crucibles in phosphate work was found satisfactory.

Directions for preparing magnesium mixture and the wash solution are included.

Determination of carbonates in limestone and other materials, J. F. Beck (New York State Sta. Tech. Bul. 62 (1917), pp. 3-7, fig. 1).—An apparatus which depends on the principle of the hydrometer and its manipulation is described.

In the apparatus the carbon dioxide is liberated from the material by dilute hydrochloric acid and the weight of the hydrometer decreased by the escaping gas. The rise of the graduated tube above the water thus records the percentage of carbonates from which the carbon dioxide was liberated. The method requires no weighing or computation of results, since the latter are given by direct reading of the graduated scale.

Comparative analytical data with the standard method indicate the accuracy of the proposed procedure. Some notes on details of manipulation, composition of limestone, and application of the method are included.

A rapid method for the determination of water-soluble arsenic in arsenate, H. A. Scholz and P. J. Waldstein (*Jour. Indus. and Engin. Chem.* 9 (1917), No. 7, pp. 682, 683).—A procedure similar to that noted by Grayson and Christie (*E. S. R.*, 36, p. 715) is described, as follows:

Five-tenths gm. of the dried and pulverized sample or 1 gm. of paste is weighed into a 250-cc. volumetric flask. Two hundred cc. of recently boiled distilled water is added and the mixture vigorously boiled for 3 to 5 minutes, allowed to stand 10 or 15 minutes, cooled, made to volume, and filtered through a filter paper. Two hundred cc. of the clear filtrate is measured into a 500-cc. Erlenmeyer flask, a few crystals of potassium iodide and 7 cc. of concentrated sulphuric acid added, and the liquid then boiled down to about 50 cc. It is then diluted with cold water, made alkaline to methyl orange with sodium hydroxide

is added with dilute sulphuric acid, and an excess of sodium bicarbonate added, then titrated with twentieth-normal iodine solution.

Experimental data submitted indicate closely agreeing or somewhat higher results by the proposed procedure when checked against official methods.

Inadequacy of the ferric basic acetate test for acetates. L. J. CURTMAN

and R. HANANS (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 7, pp. 1315-1317).---

are reported which show that the ferric basic acetate test is not sufficiently sensitive and that it does not furnish a means of roughly estimating amount of acetate present in a solution.

Inten. M. ARPIN (*Liverpool: Offices of "Milling,"* 1917, pp. 23, figs. 5).---

is a translation, together with some notes, by W. Jago of the official method for the estimation of gluten. Some notes on the interpretation of the results of the analysis of flours are also included.

The determination of pentoses and of glucose by means of Fehling's solu-

tion. H. PELLER (*Internat. Sugar Jour.*, 19 (1917), No. 222, pp. 275, 276).---

reduction of Fehling's solution by pentoses (arabinose and xylose) and by glucose is discussed.

The importance of treating the sample with Fehling's solution at from 63 to 65° C. and maintaining it at such a temperature for 10 minutes in the determination of reducing sugars in impure samples which may not contain either glucose or glucose is emphasized. In products supposed to contain either glucose or glucose the heating should be continued for 30 minutes, or else at 100° temperature for 3 or 4 minutes.

It is indicated that "the organic matter of beet molasses behaves much less actively toward Fehling's solution than that contained in cane molasses."

The quantitative estimation of dextrose in muscular tissue. R. HODGKINSON

and R. B. CHEN (*Biol. Chem.*, 31 (1917), No. 1, pp. 67-77).---

On account of the reducing action of Fehling's solution, creatinin was found to be an important source of error in the determination of dextrose in muscular tissue. For the removal of creatinin and also as an efficient precipitant for other nitrogenous constituents of muscular tissue, an excess of phosphotungstic acid was found to give excellent results. After considerable preliminary work the following method, which has yielded accurate results, was devised:

One hundred gm. of finely ground muscular tissue previously freed from fat and connective tissue is treated in a 500-cc. beaker with 200 cc. of distilled water, gradually heated to boiling, and boiled for a few minutes. During the extractions the contents of the beaker must be frequently stirred. After boiling, the insoluble material is allowed to settle and the clear liquid poured on to the previously prepared asbestos filter in a 4-in. funnel. Filtration is carried on by the aid of suction. The residue is again extracted with 150 cc. of hot distilled water as above. The operation is repeated and the residue finally transferred to the filter, washed with hot water, and filtered dry as possible.

The contents of the filter flask are transferred to an 800-cc. beaker and concentrated on the steam bath to a volume of about 25 to 30 cc. The concentrated liquid is then transferred to a 100-cc. volumetric flask, but the volume added must not be allowed to exceed 60 to 70 cc. It is cooled to room temperature, 25 to 50 gm. of phosphotungstic acid dissolved in about 25 cc. of water is added, shaken thoroughly, and let stand for a short time. The solution is then filtered to volume, shaken, and either filtered or centrifuged to remove the solid matter. The use of the centrifuge is preferable. A portion of the filtrate is tested for complete precipitation by the addition of dried phosphotungstic acid. If an appreciable precipitate forms, an aliquot portion of the

filtrate should be taken, treated with an excess of dry phosphotungstic acid, made to volume, filtered, and the filtrate tested for complete precipitation.

When the precipitation is complete sufficient dry potassium chlorid is added to precipitate the excess of phosphotungstic acid. The potassium phosphotungstate is filtered off and the filtrate tested for the presence of creatin. When an appreciable excess of phosphotungstic acid has been used for precipitation not more than a trace of creatin should be found. The sugar is determined in aliquot portions of 25 cc. of the filtrate by Allihn's method, the reduced copper by Low's iodid method.

In view of the reported increased formation of dextrose in muscular tissue during grinding for analysis, it is suggested that when the dextrose content of the sample is to be determined immediately after the death of the animal, the weighed sample be cut into several pieces, plunged into boiling water, and the boiling continued for from five to ten minutes. The clear liquid is then to be decanted, the residue ground in a meat grinder, and the extraction carried out as usual.

Determination of sugar in hay and turnips, H. K. KRISTENSEN (*Tidsskr. Plantavl.*, 23 (1916), No. 5, pp. 757-777).—Continuing previous work (E. S. R., 36, p. 807), it has been found that either water or alcohol can be satisfactorily used for extraction of the sugar in the materials. For cruciferous plants, alcohol extracts have been found to yield the most reliable results. Basic potassium acetate could not be used for clarifying the solutions, but mercuric nitrate, entirely satisfactory, and its use is recommended. The reduction of the precipitated cuprous oxid to metallic copper is considered not to be necessary, unless the solution has not been clarified by some defecating agent.

Determination of the alkalinity and phosphoric acid content of foods, J. I. M. KOLTHOFF (*Chem. Weekbl.*, 14 (1917), No. 24, pp. 547-558).—This is a discussion of the comparative merits of the author's method (E. S. R., 36, p. 204) and the method of Pfyl,¹ which depends on precipitating the phosphates as tricalcium phosphate with calcium chlorid and titrating the liberated hydrochloric acid with standard alkali, using phenolphthalein as an indicator, after converting the phosphates into primary phosphates. Some comparative analytical data obtained in the examination of pure solutions and the ash of bread, pepper, and milk powder by the above methods and the procedure of Lorenz (E. S. R., 13, p. 14) are submitted.

It is concluded in general that the method of Pfyl does not possess any advantages over the method previously proposed by the author.

Specifications and directions for testing milk and cream for butter fat, O. F. HUNZIKER (*Jour. Dairy Sci.*, 1 (1917), No. 1, pp. 38-44).—This is a report of the data on official methods of testing milk and cream for milk fat submitted at the Official Dairy Instructors' Association meeting held at Springfield, Mass., October 16 and 17, 1916 (E. S. R., 35, p. 769).

The Shrewsbury and Knapp process for the estimation of coconut oil, G. B. ELSDON and C. R. BAGSHAW (*Analyst*, 42 (1917), No. 492, pp. 72-83, figs. 2-4).—The authors have studied the method previously noted (E. S. R., 24, p. 557) and have found that the most suitable strength of alcohol to use is of specific gravity 0.92 at 15.5° C. With alcohol of this strength concordant results could be obtained with mixtures of coconut oil and butter and coconut oil and lard, and with mixtures containing up to about 60 to 65 per cent coconut oil. With mixtures containing greater percentages of coconut oil the results obtained were not so satisfactory. Where the samples contained 70 per cent or more of coconut oil, alcohol of specific gravity 0.91 was found to yield satisfactory results.

¹ Arb. K. Oesndtsamt., 47 (1914), No. 1, pp. 1-44.

washing the fatty acids once with 50 cc. of cold water was found to be sufficient.

It is indicated that the filtration should be carried out as nearly as possible at 15.5°. Cooling the alcoholic solution to about 14° and violently shaking before bringing to the final temperature of 15.5° has been found to yield more satisfactory results.

The modified procedure is described in detail and experimental data obtained in the examination of mixtures containing coconut oil submitted.

Observations and experiments on the preparation of tea, J. J. B. DRAUSS (*Indische Nijverheid en Handel [Dutch East Indies], Meded. Proefstat. Thee, 1917* (1917), pp. 34, pl. 1).—This pamphlet discusses the withering and fermentation of tea and gives results of some experiments on artificial and natural drying of tea. The data are submitted in tabular and graphical form.

METEOROLOGY.

Forecasting the seasons, A. MCADIE (*Sci. Amer. Sup.*, 84 (1917), No. 2169, p. 53-54, figs. 2).—This article briefly discusses the so-called Réseau Mondial, a world chart, in its relation to the forecasting of seasonal conditions on the basis of the position of infrabars and hyperbars. It is shown that the survey now provided makes possible certain important deductions regarding the control of seasonal conditions by the large pressure areas. The article also deals with the relation of sun spots, volcanic eruptions, and heavy cannonading to other changes. *

It is stated that "we may dismiss the question of the effect of war in making the variable weather; but we can not disregard the rather more important question of the effect of an abnormal season upon the operations of man, including crops. An unreasonable continuance of south and east winds over central Europe due to a temporary displacement of the continental infrabar may cause excessive rainfall or, at drought during the growing period and so affect the crops."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 4 (1917), Nos. 3, pp. 250, pls. 3, figs. 8; 4, pp. 217, pls. 2, figs. 3).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for March and April, 1917, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSERANDER and W. P. SAUNDERS (*Massachusetts Sta. Met. Bulet.*, 4 (1917), pp. 4 each).—Summaries of observations at Amherst, Mass.,

pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1917, are presented. The data are briefly discussed in general notes on the weather of each month.

The meteorology of Brazil, C. M. DELGADO DE CARVALHO (*Météorologie du Brésil*. London: John Bale, Sons, & Danielsson, Ltd., 1917, pp. XIX+528, pls. 1-10, 34; rev. in *Scot. Geogr. Mag.*, 33 (1917), No. 7, pp. 315-325).—This is

the main a compilation of the principal things that have been published on the climates of Brazil, with numerous references to sources of information. It includes sections of special interest from the standpoint of agricultural meteorology, as, for example, droughts and measures taken to mitigate them; frost; and the weather conditions prevailing in the regions especially suited to coffee, cacao, and sugar cane.

Three groups of climates are recognized, "(1) equatorial and subequatorial climates, which include those of the region extending to the latitude of the river São Francisco, about 11° S.; (2) tropical and subtropical climates, em-

bracing the greater part of the remaining area within the Tropic of Capricorn, and (3) temperate climates—that is, practically those of the four southern States of Brazil, beginning on the coast with Santos, just outside of the Tropic, but extending in the higher interior 2 or 3 degrees north of that line. These groups are then subdivided into regions in accordance with the race, and humidity, altitude, and situation with respect to the ocean, and in each of these the climates of minor regions are studied with reference to selected typical stations. The first group is divided into the superhumid, Amazonian type, and the semiarid or northeast Brazilian type; the second into the semihumid type of the middle latitudes, and the semihumid arid type."

It is stated that droughts are more often due to irregular and badly distributed rainfall than to actual deficiency. One of the peculiarities of farming in the drier areas of northeastern Brazil is the use of artificial reservoirs (açudes) "dotted over the surface, not for the supply of irrigation water, but led to adjacent fields, but merely to allow of the marginal tracts of land exposed after floods being cultivated during the dry season. The topography of large parts of this region is such that the lowering of the water surface in one of these reservoirs by the evaporation of 5 ft. in depth of water is enough to expose immense tracts of cultivable ooze."

The weather conditions, especially distribution of the rainfall, of the place of São Paulo are peculiarly suited to the growth of coffee. The fact that Brazilian coffee has suffered so little comparatively from diseases is attributable to the favorable weather conditions.

As regards cacao, humidity is a more important climatic requirement than temperature, since this plant is especially susceptible to injury from drought.

It is noted that among the essential climatic requirements for sugar cane is an abundance of rain. In the Campos region, where sugar cane is principally grown, there is sufficient rainfall during two or three months to make conditions exceptionally favorable for the growth of this crop. There is, however, occasional dry years, which are seriously injurious unless irrigation is freely practiced. The irregularity of the precipitation in this region is shown by the fact that during the 20 years, 1888 to 1907, the total annual rainfall varied from 8 to 95 in.

Frosts are very irregular in occurrence and distribution and do not form a constant phenomenon at any given place.

A classified bibliography is given.

The rainfall régime of Indo China, G. LE CADET (*Bul. Écon. Indochine ser.*, 20 (1917), No. 123, pp. 1-50, pls. 4).—Tables and charts are given which show the mean rainfall and number of rain days per month and per year, as well as the extremes of such data, at stations well distributed throughout the country, for periods varying from five to ten years. The characteristic features of the rainfall of the region as shown by the data are discussed, as well as certain features of the relation of the amount and distribution of rainfall to plant growth.

The average annual rainfall shown by the data reported appears to be about 1,800 mm., varying widely, however, in different years and localities. The number of rain days averages over 100. Attention is called especially to the great plant response to freshly fallen rain due to its higher radioactivity.

Dissolved oxygen in rain water, E. H. RICHARDS (*Jour. Agr. Sci. [England]* 8 (1917), No. 3, pp. 331-337, figs. 2).—Reference is made to the importance of dissolved oxygen in rain water as one of the chief factors controlling bacterial activity in soil, particularly in relation to the decomposition of organic matter. Previous investigations on the subject are briefly reviewed, and the results of

Observations at Rothamsted on the dissolved oxygen content of rainfall reported and discussed, with descriptions of the apparatus and methods.

Results show that rain water is very nearly saturated with oxygen if the temperature of collection is below 15° C., but is always below saturation occasionally as much as 25 per cent, when the temperature is above 15°.

Coefficient of correlation, W. G. KEND (Quart. Pubs. Amer. Statis. Assoc., 15 (1917), No. 118, pp. 679-684, figs. 4).—The limitations and application of the coefficient of correlation as a measure of relationships, as, for example, between July rainfall and yield of corn in Ohio, are discussed.

The coefficient of correlation is obtained by applying the least square adjustment to the material and is, therefore, the straight line of closest fit. If the relationship is not that of a straight line, it is obvious that the straight line of fit is not a good measure of the relationship and that some other measure (e. g., the correlation ratio) must be used. Therefore, the coefficient of correlation should never be used to show relationship until after the phenomena have been investigated, at least far enough to show whether a straight line satisfies the relationship as well as any other curve.

The method of procedure to be followed in applying the method is explained in detail, and a bibliography of the subject is given.

SOILS—FERTILIZERS.

Survey of Barbour County, Ala., H. C. SMITH, N. E. BELL, and J. F. HANCOCK (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1914, pp. 59, fig. 1, map 1).—This survey, made in cooperation with the State of Alabama, deals with the soils of an area of 579,840 acres in southeastern Alabama, the topography of which ranges from hilly and broken to nearly level. The drainage is developed.

The area is included in the coastal plain province, and the soils are classed as beach, stream terrace, and bottom-land soils. Including meadow, 23 soil series of 13 series are mapped, of which the Ruston sandy loam, Norfolk sand, Ruston gravelly sandy loam cover 21.3, 14.3, and 19 per cent of the area, respectively.

Survey of Chickasaw County, Miss., E. M. JONES, C. S. WALDROP, and E. HANSCOTT (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 61, map 1).—This survey, made in cooperation with the State of Mississippi, deals with the soils of an area of 329,640 acres in northeastern Mississippi, the topography of which ranges from level or undulating to rolling or hilly. Except in the Flatwoods section the drainage system of the county is developed.

Beach and soils derived from coastal plain deposits cover over three-fourths of the area. The alluvial soils of the overflowed stream bottoms consist mainly of sand and clay. Including chalk and rough gullied land, 24 soil types, of 14 series are mapped, of which the Lufkin silt loam, Oktibbeha clay, Ruston fine silt loam, and Lufkin clay cover 9.6, 9, 8.6, and 8.1 per cent of the area, respectively.

Survey of Anson County, N. C., E. S. VANATTA and F. N. McDOWELL (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 65, pls. 7, figs. 1, map 1).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 344,900 acres in central North Carolina, which lies on the boundary between the Coastal Plain and the Piedmont Plateau provinces. The topography is undulating to hilly.

"The county is thoroughly dissected by streams, and there are no large land areas without natural drainage outlets. While there are many flats and depressions, in both the uplands and bottoms, which are naturally drained, there is a much larger area from which the water flows off so fast as to cause severe erosion."

The soils of the county are of residual, sedimentary, and alluvial. Twenty-eight soil types of 13 series are mapped, of which the Georgetown loam and the Cecil gravelly loam cover 11.2 and 10.5 per cent of the county respectively.

Analyses of soils of the Belgian Congo by the physiological method SMYERS (*Bul. Agr. Congo Belge*, 7 (1916), No. 3-4, pp. 268-284, Figs. 1-4). Pot experiments are reported with oats, white mustard, and barley to determine the fertility requirements of seven typical soils of the lower Belgian Congo including black, dry, and tenacious lowland soil, fine-grained sandy soil, careous prairie soil, alluvial clay soil, brown clay forest soil, upland sandy lateritic subsoil, and upland sandy soil. The surface soils were tested to a depth of about 30 cm. (11.81 in.). Fertilizer treatment consisted of complete fertilization and of complete fertilization without nitrogen, phosphoric acid, potash, lime, respectively.

The results indicate that the soils of the lower Congo are generally deficient in nitrogen, this being the limiting factor. The addition of the other fertilizer elements without nitrogen had no appreciable effect on the vegetation. The fine-grained sandy soil and the upland sandy soil were the only soils tested showing a notable deficiency in phosphoric acid, while the upland sandy and the clay forest soils were the only soils not somewhat deficient in potash. The fine-grained sandy soil was the only soil seriously deficient in lime.

The wheat soils of Alexandria division, Cape Province, C. F. JONES (*African Jour. Sci.*, 13 (1917), No. 6, pp. 211-237).—Mechanical and chemical analyses of 10 cultivated and 10 virgin soils are reported and compared with similar analyses of wheat soils in the United States and England. Deterioration was observed for some years in the crops from these soils, especially wheat.

"Mechanical analysis showed the soils to range in physical character from medium sands to fine sandy loams, the proportions of very fine sand, silt, and clay together varying between 16 and 63 per cent, while pebbles, gravel, and coarse sand were practically absent. . . . The causes of inadequate production therefore, seem to be (1) the rather sandy character of some of the soils, joined with their inherent poverty in plant-food constituents; (2) the depletion of some of those constituents by continuous cropping without manure; and (3) the further losses caused by the surface soil suffering depletion in respect to silt and clay. The moisture conditions of the soil have not been investigated. Out of the 10 localities investigated only one is not in immediate need of irrigation of any kind, in order to fit it for wheat production. Eight require manure with nitrogen, five need potash fertilizers, and six need fertilizing with phosphates."

Some soils of the southern island of New Zealand with special reference to their lime requirements, L. J. WILD (*Jour. Agr. Sci. [England]*, 8 (1914), No. 2, pp. 154-177, Figs. 2).—Studies of the lime requirements of certain New Zealand soils, including so-called shingly inland soils, deep loams under deep clay, and alluvial soils resting on gravel and in river beds, using the Hutchinson-MacLennan method (R. S. R., 33, p. 622), are reported.

It was found that "the Hutchinson-MacLennan method for determining lime requirements of soils, when practiced under suitable standard conditions, gives more reliable indications than are obtainable by the ordinary methods of chemical analysis. The method gives indications which appear to be uniform."

ness of the actual requirement of the soil for lime as judged by economic standards; hence a correcting value seems advisable. The correcting value for soils of Canterbury Plains is about 0.1 per cent. The greater acidity and lime requirement of soils of the Southland Plains appears to be due to a condition of lack of natural underdrainage and high rainfall, which prevents leaching and oxidation of organic matter, so that 'sour' humus accumulates in the soil.

Acidity of soils which are acid through exchange of ions, H. H. HARRIS (*Landw. Vers. Stat.*, 89 (1916), pp. 39-80; *abs. in Jour. Chem. Soc.*, 1916, 119 (1916), No. 650, 1, p. 876; *Chem. Abs.*, 11 (1917), No. 8, p. 1008).—Experiments with two pine-forest soils and a soil on which the vegetation consisted of a few hillyberry bushes are reported.

Two forest soils, which were covered with a layer of humus from 2 to 3 cm. (2.5-1.18 in.) deep, showed considerable activity when treated with a normal solution of potassium chlorid, while the third soil failed to react. The latent acidity of the forest soils is attributed to the action of humic acids on the forest soil and the production of aluminum and iron salts. It is shown that the acidity of humus extracts is approximately the same as that of acetic acid of the same strength, and that latent acidity can be produced by treating forest soils with raw humus. The same result was obtained with only partly humified vegetable substances. It is also thought possible that latent acidity can arise from the production of soluble aluminum and iron compounds by humus itself and the penetration of the soluble salts into the mineral soil with the humus.

Movement and distribution of moisture in the soil, F. S. HARRIS and H. W. HARRIS (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 5, pp. 115-155, 1917). Field and laboratory soil moisture experiments conducted at the Utah Agricultural Station under irrigation and dry-farming conditions, and representing several thousand moisture determinations, are reported. The field studies show the effect of fallow, kind of crop, manure, irrigation water, surface tillage, cultural methods, and seasonal conditions on the movement and distribution of soil moisture. The laboratory studies included the effect of the percentage of moisture, gravity, soil type, source of supply, etc.

In fallow soils the moisture content of the fallow soils averaged greater than that of the cropped soils. Unmanured irrigated land showed less difference in moisture between cropped and fallow than did the manured. Irrigation increased the top feet of the cropped plots proportionately more than the fallow, but water did not appear to penetrate the fallow plots below 7 ft. as readily as did the cropped ones.

Under dry-farming conditions the difference in moisture between cropped and fallow plots was not noticeable until after June 16. Cropped plots showed more moisture than fallow ones. Wheat, corn, potatoes, and peas drew most of the moisture from the first 4 ft. in depth. The wheat land contained less moisture in the fall than the other cropped soils, with corn following.

The increase in moisture due to applications of from 5 to 7.5 in. of irrigation water was felt to depths of 10 ft. in 24 hours, although most of the increase was in the first 4 ft.

The effect of mulches in preventing moisture loss under both irrigation and dry-farming was noticeable several feet below the surface of the ground, but surface foot showed the greatest benefit from mulches. A straw mulch acted considerably better than a 2-in. soil mulch. Mulches on irrigated plots seemed to influence the moisture content of the soil to greater depths than did under dry-land conditions. A dry-farm plot kept free from weeds in

1916 but not mulched lost very little more water than one mulched 2 in. deep. A 6-in. cultivation on spring-plowed and a 2-in. cultivation on fall-plowed farm land seemed to conserve the moisture best.

Subsolling 15 in. deep had little influence on the moisture; spring digging was a rather distinct benefit. Spring plowing under dry-farming conditions at Nephel conserved moisture better than fall plowing, this difference in favor of spring plowing being shown more below the first foot than in the first foot, and more in the summer and fall than in the spring.

A precipitation as small as 0.1 in. under dry-farming conditions could not be detected in moisture determinations soon after, but when as much as 0.5 in. fell within a short time an increase in moisture was noticed to a depth of 6 in.

"When freely supplied with water, a soil with a high initial percentage of moisture will come to a moisture equilibrium sooner than a drier one. For a given time the drier soil will absorb a greater quantity through a long distance, either upward or downward than will the wet one. The rate of moisture penetration in the first 10 days was nearly twice as great with initial percentages above 15 as with 5 or below, and nearly twice as rapid after a 15-in. infiltration as after a 5-in. one. Under the most favorable conditions 7 ft. was influenced in 10 days. Moisture movement from soils of optimum moisture content into soils of differing initial percentages varied to an extent inversely to the initial content of the dry soil. At the end of six weeks, however, the amount of water actually in the soils still varied directly as the initial percentage. The higher the percentage of moisture in the soil supplying the water to a dry soil, the more rapidly and farther from the source of water did the moisture move. Even when the source of water was an unsaturated soil, a greater and faster movement took place when the water was moving downward than upward. When the quantity of soil yielding the water was so small as to make the total moisture content of both moist and dry soils very low if equally distributed, the effect of gravity was not great.

"Moisture from a nearly saturated soil moved a greater distance into loam than into sand in 189 days and into sand farther than into clay. The loam, however, contained more moisture in the layer of soil next the water supply than the others, and sand contained by far the least. Sand, with 7.57 per cent of moisture, gave up its moisture to loam much more readily than did loam with 31.09 or clay with 24.62 per cent of moisture. The rate of rise of moisture from soils of varying fineness when used either as water sources or water absorbers varied inversely with the fineness. Water rose to a height of over 10 in. in a loam soil from a moist sand in 94 days, while from a moist clay it rose little more than 6 in. in this length of time. In all soils the most rapid rise of the water was during the period soon after being placed in contact with the water. Although the rise of the moisture was more rapid in the sand and loam than in the clay, the rise continued steady longer in the clay than in the others.

Adsorption by soils. J. E. HARRIS (*Jour. Phys. Chem.*, 21 (1917), No. 6, pp. 454-473).—Further experiments at the Michigan Experiment Station on the subject (E. S. R., 31, p. 814), using uniform samples of sandy loam soils were reported. The purpose was to secure additional evidence that the cause of soil acidity is due to colloidal adsorption or to the presence of true acids, and to secure data on the action of fertilizer salts.

It was found that "when a soil or kaolin is treated with salt solutions of varying concentrations the quantities of the cation adsorbed follow very closely the adsorption isotherm represented by the equation $x/m = ac^n$, indicating that the action is one of adsorption and not of double decomposition.

"When the soil was treated with different salt solutions it was found that the number of equivalents of the different cations adsorbed was not the same. 1

with reference to their tendency for being adsorbed occurred in the order Al, K, Ca, Mn, Mg, and Na. The numbers for the ions Ca, Mn, and Mg were very nearly the same. . . . The metals, with the exception of the potassium, occur in the order of their valence and . . . metals of the same valence have practically the same values.

It was found that a soil that had adsorbed large quantities of potassium in the part of this up when treated with various salt solutions. In the case of potassium itself it was found that, with reference to their ability to set free adsorbed potassium, the salts occurred in the following order: $AlCl_3$, NH_4Cl , $ZnCl_2$, $CaCl_2$, Cr_2SO_4 , $MgCl_2$, $NaCl$, $CaCO_3$.

When the soil was treated with a mixture of salts it was found that the effect of each ion adsorbed was cut down by the presence of the other. The number of equivalents adsorbed from the mixture was greater, however, than either of the salts alone."

Results of soil fertility studies. C. B. WILLIAMS (*North Carolina Sta. Rpt. 1899, p. 116*). Chemical and petrographic studies of the soils of North Carolina have shown that "wide variations in the total amount of the elements that feed . . . exist between the soils of the Appalachian Mountains, Piedmont, and Atlantic coastal plain. The soils of the first physiographic division are better supplied with phosphoric acid, potash, and lime than are any of the other two provinces. . . . Those of the Piedmont plateau are, as a rule, better supplied with potash and lime and with phosphoric acid in rather small amounts in some cases. On the other hand, the soils of the coastal plain and of Albemarle Sound are markedly deficient in all essential elements of the growth. Nitrogen is usually low in a majority of the soils of all three sections of the State."

Chemical studies of these soils correlate markedly with the chemical facts. Topography plays an important part in their chemical composition. Most of the mountains are formed from the same or similar rock as are those to be found in section, but in the mountains the soil mantle is not so well developed. Usually there are mere of the minerals found in the parent rock in the soil, and covering has been removed. The coastal plain soils are badly deficient in minerals except quartz.

Correlating these studies with the field tests, using various crops as indicators, and measuring the relative densities of the soil solution, close relationships have been found between the chemical and mineral composition of the soils of the State and their requirements for plant nutrients. Nitrogen is either the first or second element required by all the soils under experiment.

There are with four distinct types of soil in the mountain sections, namely, Porter's loam, Toxaway silty loam, and Toxaway loam, show similar results. Four types "phosphoric acid is needed first, and potash shows no gains with different crops, except where complete fertilizer is used and large crops produced. Lime alone shows gains on leguminous crops, and when used with complete fertilizer a gain is made. On Porter's clay and Porter's loam lime is second in importance to phosphoric acid, and has to be supplied to produce good crops. Toxaway loam and Toxaway silty loam need nitrogen for good crops, but not so much as the upland mountain soils to produce remunerative crops."

Field tests of Piedmont soils, Cecil clay near Charlotte, Cecil clay loam near Salisbury, and Cecil sandy loam near Gastonia, all show phosphoric acid to be the limiting constituent of plant food, with nitrogen second. Very little gain is derived from potash, except where used in a complete fertilizer. The tests on the Fred-ell loam near Charlotte show that nitrogen is the first element and food needed, with potash and lime next. Although a complete fertilizer

with lime gives best returns where phosphoric acid alone is used, no increase is secured. Alamance silt loam near Monroe, Durham sandy loam near Raleigh, and Norfolk coarse sand near Hoffman all show nitrogen to be the most limiting element of plant food, with phosphoric acid and potash, giving good gains when used with phosphoric acid and nitrogen. For large crops a good supply of all of the plant food constituents with lime is needed, as well as an increase in supply of vegetable matter. On the Cecil clay soils potash either gives no gain or depresses the yields. On other phases of the Cecil series of soils experiments show that nitrogen is the chief limiting element of plant food for the yields of crops, with additions of phosphoric acid needed for best crops. Potash is of least importance.

Field tests with coastal plain soils show that "with the exception of nitrogen is the limiting element of plant food, . . . with potash and phosphoric acid needed to produce good gains in crop yields. The results on Norfolk sandy loam at Elizabeth City have shown that phosphoric acid comes before potash in importance. . . . On the muck soil, lime seems to be of first importance, [followed in order by] . . . phosphoric acid, potash, and nitrogen. . . . Nitrogen, potash, and phosphoric acid give best returns when used in connection with lime. Norfolk sand at Greenville gives evidence of needing humus-forming material before any fertilizer can be used with profit. On peaty soils, the addition of potash and phosphoric acid seems to have a depressing effect so far when used alone or in combinations without lime."

Thirty-five years' results with fertilizers, F. D. GARDNER, C. F. NORTON, P. S. BAKER (*Pennsylvania Sta. Bul. 146 (1917), pp. 3-29, figs. 11*).—This is a summary of the results of experiments begun in 1881 and previously reported (E. S. R., 34, p. 128) on the use of commercial fertilizers, barnyard manure, lime and land plaster in a rotation of corn, oats, wheat, and mixed clover and timothy grown on residual limestone soil varying from clay to silt loam in character.

It was found that in the absence of manure or fertilizers of any kind the fertility of this soil showed a marked decline. The average yield of all crops in the rotation for all of the untreated plats during the last five years was 61 per cent as much as the yield for the same plats and crops during the first five years. The reduction in yield was most pronounced in case of hay and wheat. Wheat started with a comparatively low yield and showed the smallest decline in yield. The average yield of both wheat and wheat straw during the last five years equaled 94 per cent of the yield during the first five years.

"Phosphoric acid is the limiting factor in crop production on this soil. The average yield on the plats treated with phosphoric acid alone is 18 per cent more than the average of the check plats and 41 per cent more than the average of the check plats which are nearest to the phosphoric acid treated plat. Ground bone as a source of phosphoric acid appears to be slightly more efficient than dissolved bone black."

Potash alone had no appreciable effect on the yield of crops, but potash applied with phosphoric acid gave a very marked increase in yield over phosphoric acid alone, and very materially increased the profits on the fertilizer applied. The use of 100 lbs. of muriate of potash per acre in alternate years is believed to be sufficient to meet the needs for the crops grown on this soil. Potash with phosphoric acid in combination proved to be the most profitable mixture. This combination in this rotation, in which clover occurs once every four years, practically maintained the fertility of the soil for a period of 35 years.

Nitrogen alone and a combination of nitrogen and potash had no appreciable effect on these crops. Nitrogen in addition to phosphoric acid and potash produced a considerable increase in yield of crops. Of the three forms of nitrogen

gum nitrate gave a larger average increase in crops than either dried blood or ammonium sulphate. During the first ten years of the experiment, ammonium phosphate was superior to either sodium nitrate or dried blood, but later the phosphate and crops began to fail on the ammonium sulphate plots.

One of the plots used in this comparison of sources of nitrogen have been since the experiment was begun. "On the plots where the heaviest applications of sulphate of ammonia have been made there are large areas where all is dead. This we believe is due to the acidity of the soil, especially since in 1914, when soil from these most acid plots was limed, the yields of clover were excellent. . . . The nitrate of soda plots are least acid, and the crops are probably not reduced by a lack of lime. On some of the dried blood plots the acidity has become too great for a good growth of clover though other plots do not show signs of injury."

Superior commercial fertilizers, except where ammonium sulphate was used and barnyard manure were about equally efficient in maintaining the fertility of the soil. The heavier applications of each caused the yields during the five or ten year periods to exceed those of the first five or ten year periods of the experiment.

Heavier applications in different amounts showed that there is economy in light applications when used for general farm crops. The money return per ton of lime when applied at the rate of 6 tons per acre twice in a rotation, was \$2.23 compared with \$2.23 per ton when applied at the rate of 10 tons per acre once in the rotation.

Whether as slaked lime or as carbonate of lime applied alone in large amounts frequently gave a small increase in yields of crops. Burnt lime alone for a period of 35 years gave an average increase of 701 lbs. of total products per acre in a rotation, as compared with the untreated plots immediately adjacent. Pulverized raw limestone under the same conditions gave an average increase of 1,334 lbs. of total products in a rotation, as compared with untreated plots nearest to the pulverized limestone plots. The larger return from burnt lime was where it was used in conjunction with barnyard manure. In some cases there was an increase of 1,001 lbs. of produce per acre in a rotation and at \$638. Land plaster or gypsum had no measurable effect on the crops and did not prevent the soil from becoming acid.

For the limestone soils of Pennsylvania it is recommended that manure be applied at the rate of about 6 tons per acre for corn, and supplemented with 100 lbs. per acre of acid phosphate. For oats which follow the corn, no fertilizer is required. For the wheat which follows oats, 350 lbs. per acre of acid phosphate, 100 lbs. of muriate of potash, and not more than 10 lbs. of nitrogen, suitably in an organic form, is recommended. For the clover following wheat, fertilizer will be required. On timothy occurring the fifth year in a rotation, dressing of 150 lbs. of acid phosphate, 150 lbs. of nitrate of soda, and 50 lbs. of muriate of potash will give good results."

Injurious effect of farmyard manure on the balance of nitrogen in the soil, SHASHNIKOV (SARACHNIKOV) (*Selsk. Khoz. i Lesov.*, 359 (1916), Jan., pp. 1-10), in *Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 1916, No. 6, pp. 802, 803; *Chem. Abs.*, 11 (1917), No. 9, p. 1242).—The chief balance of barnyard manure on the balance of nitrogen in the soil is attributed to the organic matter it contains and not to microorganisms, which are considered of secondary importance. The organic matter in the manure (especially undercomposed straw), being a good source of carbon for the soil microorganisms, contributes (1) in an aerobic environment to the assimilation of nitrates, ammonia, amides, and gaseous nitrogen, and their deposition in protein

form; and (2) in an anaerobic environment in the presence of nitrate by assimilation of the latter, and also on the other hand to its denitrification.

The nitrogen in barnyard manure is considered to be chiefly in an organic form, and its loss in the gaseous state is thought to be possible without its passing into the nitric state, both in the aerobic and anaerobic environment. The organic matter, contributing to the conversion of the protein nitrogen, indirectly promotes the loss of nitrogen in further decomposition. A local retardation of furrows, etc., of the nitrifying processes is also possible owing to the organic matter, to the presence of which the nitrifying organisms are known to be sensitive.

As to the question whether barnyard manure supplied to the soil in quantities up to 28 tons per acre reduces nitrification or not, it is thought that a final conclusion can not be drawn. It is considered possible that the presence of vegetable residues in the soil and the continuous conversion of nitrogen from the soluble form into the organic form or vice versa may cause such heavy loss of nitrogen (although compensated by its assimilation from the air) that the effect of the additional organic matter in the form of barnyard manure is relatively unimportant.

[Manure conservation experiments], C. D. Woods (*Maine Sta. Bull.*, 1917), pp. 94-99).—An experiment on the storage of cow, horse, and sheep manure during the winter is reported, in which an account was given of all feed eaten and the manure was stored in a water-tight platform (as is described) and kept worked by swine to prevent fire fangling. The composition of the mixture of cow, horse, and hog manure as removed from the platform was nitrogen 0.457 per cent, phosphoric acid 0.19, and potash 0.5. The mixed manure contained nitrogen 0.74 per cent, phosphoric acid 0.29, and potash 0.74. "Seventy-nine per cent of the nitrogen, 87 per cent of the phosphoric acid, and 87 per cent of the potash in the feeding stuffs used were found in the mixed manure, and 61 per cent of the nitrogen, 56 per cent of the phosphoric acid, and 67 per cent of the potash in the feed and bedding given the cows and horses were found in the mixed manure."

It is estimated that the sheep and swine manure was worth about \$2.00 and the mixed manure about \$3 per cord at the manure pit.

The effect of phosphoric acid upon the decomposition of sugar in the soil. S. HERKE (*Kisérlet. Közlem.*, 18 (1915), No. 5-6, pp. 857-866; *abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 5, pp. 646; *Jour. Soc. Chem. Indust.*, 35 (1916), No. 21, p. 1125; *Chem. Abs.*, 11 (1916), No. 10, p. 1511).—Experiments are reported which showed that the decomposition of sugar in a soil, as indicated by the liberation of carbon dioxide, is influenced by the chemical composition of the soil and by the presence of certain nutritive salts. In a soil to which phosphoric acid was added the sugar decomposed more quickly than in the same soil without the addition of phosphoric acid. The difference between the amounts of carbon dioxide liberated from the treated and untreated soils increased for a certain time and then decreased.

A certain correlation was observed between the effect of the phosphoric acid on the decomposition of the sugar and the increased yield produced by the fertilizer experiments. Thus, in a soil where the addition of 0.06 gm. of phosphoric acid per kilogram of soil increased the yield of oats and mustard, the same amount of phosphoric acid increased the amount of carbon dioxide liberated in the presence of 2 per cent of dextrose or saccharose. Increasing amounts of phosphoric acid also gradually increased the liberation of the carbon dioxide liberated.

presence of calcium carbonate and of ammonium sulphate at the rate of 5 gm. of nitrogen per kilogram of soil promoted the decomposition of sugar. Small amounts of nitric nitrogen (0.05 gm. of nitrogen, in the form of sodium nitrate per kilogram) also increased the liberation of carbon dioxide except in the free solution in which 0.1 per cent sodium nitrate exercised an inhibiting effect. Potassium sulphate increased the liberation of carbon dioxide in some cases and decreased it in others.

These results are taken to indicate that the effect of phosphoric acid is greatly influenced by the addition of nitrogenous and potassic compounds. Owing to the nature of the soil, any quantitative variation in one as a rule would change the action of the other.

The potash question and general farm crops, A. W. BLAIR (*New Jersey Agric. Jour.*, 67 (1917), pp. 3-7).—It is stated in this circular that with the exception of the very sandy sections of the State, New Jersey soils contain a fairly good quantity of potash which has been derived from the original rocks and glacial deposits. The greater part of this potash is unavailable and, on the basis of results at the station, the incorporation of organic matter, deep plowing, thorough cultivation, and liming are recommended for setting some of it free.

Potash in New Zealand and other countries, P. G. MORGAN (*Jour. Agr. [New Zealand]*, 14 (1917), No. 4, pp. 257-273).—This article gives general information regarding the present potash situation, possible sources of potash, and methods of rendering potash available to the farmer, with special reference to New Zealand conditions. Some of the natural sources of potash recommended for use by farmers in New Zealand are calcareous clay stones, glauconitic rocks, and calcareous green sandstone.

A discussion concerning the rational use of lime on the farm (*Bul. N. C. Agr. Expt. Sta.*, 33 (1917), No. 1, pp. 22).—This circular gives information on the selection, purchase, and use of lime for agricultural purposes.

Notes on humus, humogen, and its accessory plant food substances, A. F. F. (No. *African Jour. Sci.*, 13 (1917), No. 6, pp. 239-250).—This is a review of the work of others on the soil humus question, special attention being given to the Bottomley bacterized peat process.

The plant food materials in the leaves of forest trees, P. SERREY, JR. (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 6, pp. 1286-1296).—Experiments conducted to determine the plant food constituents of the leaves of the chestnut, sugar maple, and white oak at the beginning of their activity in spring and at the end of their growth in the fall are reported.

It was found that "the leaves collected in the spring show a higher content of nitrogen and potash than those collected in the fall from the same trees. The phosphoric acid content varies with the species of tree and also with the position of the tree from which the leaves were obtained. The lowest amount of nitrogen and phosphoric acid occurred in those leaves collected from trees grown upon a clay soil. The highest content of nitrogen, phosphoric acid, and potash occurred in those leaves collected from trees grown upon the Holyoke and Wethersfield loam. The leaves from the upper branches of the apple and oak have a higher content of nitrogen, phosphoric acid, and potash than the majority of cases than those taken from the lower branches. In the case of the chestnut the reverse appears to be true, the leaves from the lower branches having the larger amount of nitrogen, phosphoric acid, and potash, with some exceptions, than those removed from the upper branches. The estimated theoretical cash value of a ton of leaves calculated upon a 20 per cent moisture basis varies from \$3 to \$6.50, depending upon the kind of leaves and on what portion of the tree they were grown. The cost of collecting and handling would probably be greater than the value of the leaves, thus

making it inadvisable in most cases for farmers to spend their time in this way."

Fertilizers and industrial wastes, F. W. BROWN (*Saturday Even. Post*, 189 (1917), No. 48, pp. 121, 122; *Amer. Fert.*, 47 (1917), No. 1, pp. 53, 62, 64, 68).—Attention is called to the loss of nitrogen, potassium, and phosphoric acid compounds in industrial wastes, especially of potash in cement mills and blast-furnace gases.

Analyses of fertilizers (*Bul. N. C. Dept. Agr., Sup.*, 38 (1917), No. 2, pp. 41).—This bulletin contains the results of actual and guaranteed analysis of 54 samples of fertilizers and fertilizing materials collected for inspection in North Carolina in February, 1917.

Fertilizer analyses (*Bul. N. C. Dept. Agr.*, 38 (1917), No. 3, pp. 14).—This bulletin contains the results of actual and guaranteed analyses of 268 samples of fertilizers and fertilizing materials collected for inspection in North Carolina during the spring of 1917.

AGRICULTURAL BOTANY.

International catalogue of scientific literature. M—Botany (*Internat. Cat. Sci. Lit.*, 13 (1916), pp. VIII+812).—This volume (E. S. R., 35, p. 29), though listing mainly the literature of 1913, includes some of previous years, going back as far as 1901.

[Some investigations in the department of experimental evolution] (*Carnegie Inst. Washington Year Book*, 15 (1916), pp. 133, 134).—This section of the report of this department includes condensed information on the results of work by J. A. Harris on the correlation between characters of leaves in normal and abnormal bean seedlings, the correlation between homologous parts of a plant, and a table of osmotic pressures based on depression of freezing point; by him with Lawrence on plant sap in relation to environment on the Arizona deserts; and by these with Gortner on expressed vegetable saps as affected in their concentration by continued pressure.

Wild flowers worth knowing, N. BLANCHAN, adapted by A. D. DICKINSON (*Garden City, N. Y.: Doubleday, Page & Co.*, 1917, pp. XVIII+270, pls. 48, figs. 39).—This book, adapted from *Nature's Garden*, a previous work by the author, deals with a number of well-known families of plants. The nomenclature and classification of Gray's *New Manual of Botany*, seventh edition, are followed throughout.

Fungi from Val d'Aosta, P. A. SACCARDO (*Nuovo Giorn. Bot. Ital., n. ser.*, 24 (1917), No. 1, pp. 31-43).—Among a number of fungi collected at various altitudes in Val d'Aosta in 1916 and submitted for examination to the author, he has designated as new species *Clitocybe thuilensis*, *Erobasidium aequale*, *Spharonema oreophilum*, *Namosphera chanousiana*, *Rhaddospora bernardiana*, *Cylindrosporium vaccarianum*, *Sporodermium fumagineum*, and *Nothodiscus antoniae*, the last named being considered also as representing a new genus.

Fungi causing discolorations in paper, P. SÉZ (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 5, pp. 230-232).—Brief descriptions are given of discolorations caused in paper by the development of spores of certain fungi, also an account of culture studies therewith.

On *Stigeosporium marattiacearum* and the mycorrhiza of the *Marattiaceae*, C. WEST (*Ann. Bot. [London]*, 31 (1917), No. 121, pp. 77-99, pl. 1, figs. 9).—The author describes a fungus, supposedly a new species and here named *S. marattiacearum*, which forms an endotrophic mycorrhiza with roots of certain genera (*Angiopteris*, *Archangiopteris*, *Kaulfussia*, and *Marattia*) of *Marattiaceae*, giving a discussion of its biology, systematic position, and probable

life history. A brief description is also given of a mycorrhizal fungus said to enter into association with roots of *Danaea*.

The chemical conditions for the development of reproductive organs in yeasts, K. Saito (*Jour. Col. Sci. Imp. Univ. Tokyo*, 39 (1916), Art. 3, pp. 73).—The author has made a study of the influences bearing upon the production of the organs of reproduction in *Zygosaccharomyces mandshuricus*, *Schizosaccharomyces octosporus*, and *Saccharomyces mandshuricus*. He states that though these resemble other fungi in that reproduction stands in close relation to the quantity and quality of the chemical substances available, reproduction depends also, in case of certain organisms, upon the presence of specific chemical substances. Several such requirements are indicated. Among the significant physical considerations, osmotic activity plays an important rôle in determining concentrations and consequent development of reproductive parts. The factors, both internal and external, are thought to be very numerous, and together to constitute a very complex mechanism.

Microchemical studies in the progressive development of the wheat plant, SCHULTZ H. ECKENSON (*Washington Sta. Bul.* 139 (1917), pp. 3-21, figs. 13).—The author states that the progressive chemical changes during the development of the wheat grain are correlated with morphological changes, each definite period of the morphological development being characterized by some chemical difference. The progression of these chemical changes was found to be alike in all varieties tested of both winter and spring wheat.

Summarizing her results, the details of which are given, the author reports that inorganic materials are high in the young plant. The largest amount of potassium nitrate was found, chiefly in the root and stem, just before the formation of the spike, after which it decreased gradually. Free magnesium quickly fell to a minimum during the formation of the aleurone, while free phosphate rose to a maximum during development of the sporogenous tissue, falling to a minimum after the development of the sex cells.

Asparagin is thought to be a very important nutritive substance, and it was found together with fructose in all young growing parts. The occurrence of pectic substances on the stigma is considered especially important in reducing the rate of water absorption by pollen grains. During the period from the fertilization of the egg to the mature grain, there is said to be a stream of nutrient materials for the growing embryo coming to the endosperm from the leaves and glumes. Any excess of sugar was found to condense immediately into starch. Excess of asparagin and amino acids remained as such in the endosperm cells until desiccation of the grain. The nitrogenous compounds in the endosperm just before ripening of the grain, aside from aleurone and protoplasm, are asparagin, arginin, histidin, and some leucin. No glutamin was found.

Protein, which has the physical characteristics of gluten, is said to appear in the storage cells on desiccation of the grain, the amino acids and most of the asparagin disappearing. The formation of the storage protein in wheat is believed to be a condensation process.

The physiological rôle of calcium in vegetable life, THÉOËRE ROBERT (*Rev. Gén. Sci.*, 28 (1917), No. 4, pp. 101-108).—The author discusses the ability of plants to utilize calcium in their economy, as deduced from the examination of a very large number of investigations by various authors, taking up more particularly the relation of calcium to phanerogams, including the distribution of calcium in its various forms in the plant body; its necessity, or at least utility, in relation thereto; its mode of action or rôle as plastic, catalytic, toxic, or antitoxic; and its replacement or substitution by other elements.

The influence of some organic substances on plants, I. G. CIAMICIAN and C. RAVENNA (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5, ser., 28 (1917), I, No. 1, pp. 5-7).—This article, which is related to previous work (E. S. R., 36, pp. 329, 432) and is regarded as suggestive of further studies on a larger scale, discusses briefly the effects on plant growth of several organic substances, including mandelic nitrile, nicotine, strychnin, caffeine, and morphine.

Quantitative experiments demonstrating the mechanism of the inhibition of growth. J. LOHN (*Proc. Soc. Expt. Biol. and Med.*, 14 (1917), No. 7, pp. 131, 132).—The author has studied by a quantitative method the laws of inhibition, several reports regarding which have been noted previously (E. S. R., 34, p. 730; 35, p. 820; 37, pp. 324, 325). Proceeding upon the hypothesis of inhibition of growth by one organ in relation to another by the removal of material necessary for growth, and upon the expectation that if such were the case the total mass of shoots produced by a leaf in a certain time would be approximately the same regardless of their number, he claims to have found that this is true to a surprising degree of exactness. The quantitative data so obtained, as briefly indicated in the statement, are relied upon to furnish the basis of a chemical theory of regeneration.

Studies in permeability. —IV, The action of various organic substances on the permeability of the plant cell, and its bearing on Czapek's theory of the plasma membrane, W. STILES and I. JØRGENSEN (*Ann. Bot. [London]*, 31 (1917), No. 121, pp. 47-76, figs. 15).—The authors have carried forward the series of studies the last noted of which was contributed by Mildred Hind (E. S. R., 36, p. 433). The present contribution relates partly to tests made by the author as bearing upon Czapek's theory of a plasma membrane, earlier (E. S. R., 24, p. 137) and later reports on which are discussed, with a statement of alleged reasons for the rejection of some views held by that author.

The method employed is here described in more detail than in the article previously noted (E. S. R., 35, p. 224), with an account of its supposed advantages over the methods formerly used, such as greater exactness and more general applicability.

It is stated that with each organic substance a higher rate of exosmosis corresponded to a higher concentration of the substance employed. Equimolecular solutions of different substances do not bring about the same exosmosis. The rate of exosmosis produced by a solution is not a function of its surface tension alone. A concentration below which exosmosis of electrolytes could not take place was not found. In the attempt to deduce a mathematical time-rate expression for exosmosis, it was found that the equation expressing the results of actual experiments exactly resembled that expressing theoretical considerations.

The osmotic concentration of the sap of the leaves of mangrove trees, J. A. HARRIS and J. V. LAWRENCE (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 32 (1917), No. 3, pp. 202-211).—Presenting the results of a series of determinations of the leaf tissue fluids of *Avicennia nitida*, *Rhizophora mangle*, and *Laguncularia racemosa* on the southern shore of Jamaica and in southern Florida, the authors state that the concentration of these fluids is relatively high throughout, the range as noted lying between the limits of 20 and 50 atmospheres. *Avicennia* apparently developed a much higher concentration than the other species in the same environment.

The origin of chromoplasts and the mode of formation of xanthophyll and carotin pigments, A. GUILLERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 164 (1917), No. 5, pp. 232-235).—Giving a résumé of related studies to date, the author states that the various forms in which pigments may appear can be arranged under three general heads. These are according as to whether the

pigment in question occurs in a diffused or finely granulated state in the mitochondria or the chloroplasts derived from them, as a result of a process of crystallization subsequent to such origin, or in diffused granular or crystalline form in the large chromoplasts resulting from the metamorphosis of the chloroplasts previously formed out of the mitochondria, such mitochondrial origin explaining the elongated early form of the chloroplasts. The formation of vegetable pigments is effected by a process very similar to that which has been recently shown to occur in the cells of animals.

The anthocyanin pigments of plants, MURIEL WHELDALK (*Cambridge: University Press, 1916, pp. X+318*).—The object of this book is to provide a somewhat complete account of the various reports which have been made regarding the anthocyanin pigments as studied along botanical, chemical, and genetical lines. While not claiming that anthocyanins will ever possess great botanical significance, when compared with that of chlorophyll, for example, the author thinks they may develop a wide field for research in connection with problems of inheritance. Owing to the increasing availability of satisfactory methods for the isolation, analysis, and determination of the constitutional formulae of these pigments on the one hand and Mendelian methods for determining inheritance on the other, the two methods combined furnish a reasonable hope that inheritance phenomena may eventually be expressed in terms of chemical composition and structure.

The eight chapters of the first part deal with the anthocyanins as regards their morphological and histological distribution, their properties and reactions, isolation and constitution, physiological conditions, factors, reactions, and significance. The second part considers the anthocyanins in relation to genetics. An extensive bibliography is given.

Environmental influences on nectar secretion, L. A. KENOYER (*Iowa Sta. Research Bul. 37 (1916), pp. 219-232, fig. 1*).—The results are given of studies of a number of species of flowers, among them varieties of clovers, alfalfas, gerardias, and lilies, to determine the factors which stimulate or retard the secretion of nectar.

It was found that by increasing humidity, the secretion by the nectaries of water, but not of sugar, was increased. Excessive water supply lessens the sugar surplus, and dilution and washing by rain causes much of the sugar of the nectaries to be lost. The rate of secretion for both sugar and water increases with the temperature up to a certain optimum. Accumulation of sugar in the flower varies inversely as the temperature. The optimum condition for sugar secretion was found to be an alternation of low and high temperatures. Variation of atmospheric pressure has no marked influence on secretion. Sugar excretion is markedly diminished in darkness on account of the limitation of the food reserves of the plant. Water excretion may or may not be limited in this manner, depending on the species. The greatest amount of sugar was found to be secreted under the most favorable conditions for growth and vigor for the plant. Other things being equal, nectar is most abundant early in the blooming season, and the accumulation and secretion of sugar is most pronounced near the time of the opening of the flower.

Environmental influences on nectar secretion, L. A. KENOYER (*Bul. Gaz., 68 (1917), No. 4, pp. 240-265, fig. 1*).—This is essentially the same as the article noted above.

The consequences of precocity in spring vegetation, 1916, O. OROIX (*Compt. Rend. Acad. Agr. France, 3 (1917), No. 1, pp. 49-52*).—Warm weather during nearly all of the winter and spring of 1915-16 resulted in the production of three periods of blooming in apricot trees, occurring about the middle of the months of January, March, and April. A heavy snow February 25 and con-

thinned cold completely arrested growth for the time being, and resulted in very great reduction of the fruit crop.

Fruit injury during the fumigation of citrus trees, R. S. WOOLAM (*Fruit World Austral.*, 17 (1916), No. 3, pp. 70-72).—Giving the results of observations on the degrees and phases of fruit pitting after the use of cyanid gas to kill insects on citrus trees, the author holds that the cyanid gas itself is the basic cause of general fruit pitting, other factors being the strength of the gas used, length of exposure, condition of plants treated, and moisture, along with minor or contributing factors.

Mechanical injury, favoring the gas injury, is caused by drawing the tents over the trees, especially when they are wet or when the tent poles are low. Pressures on the growing fruit appear to weaken resistance near such points as in cases where fruits are pressed together. Trees which have been sprayed with Bordeaux mixture should not be fumigated for about a year after spraying as leaves and fruit may be dropped as a result of such treatment.

The history and legal phases of the smoke problem, L. JOHNSON (*Metalurg. and Chem. Engin.*, 16 (1917), No. 4, pp. 199-204).—Dealing very briefly with the history and bearings of smoke-injury problems, the author reviews some phases of the investigation carried out by, or in connection with, the Selby Smelter Commission selected to investigate the questions arising in the Selby smelter smoke zone (E. S. R., 34, p. 716; 35, pp. 133, 243, 244).

It is said to have been found that dust and acid vapors were practically negligible factors in the fume problem so far as vegetation is concerned, any damage actually done being traceable almost wholly to sulphur dioxide. Vegetation can stand on the average, it is said, 50 times the strength of sulphuric acid that it can bear of sulphur in the form of sulphur dioxide, the latter, however, producing little or no injury when the plants are not in leaf. Both crude sulphur and sulphuric acid increased crop yields in most instances, and practically without exception in alkaline soils. When leaf stomata were closed, as in darkness, the plants were very resistant to sulphur dioxide.

Four prominent factors in this connection were light, humidity, temperature and direction of the wind (where the latter is constant, puffs of wind having but little influence in this connection). Much of the injury previously ascribed to smoke is said to have been due to such factors as fungus diseases.

FIELD CROPS.

The experimental error in field trials and the effect on this error of various methods of sampling, C. MIYAKE (*Ber. Ohara Inst. Landw. Forsch.*, 1 (1916), No. 1, pp. 111-121, figs. 2).—The experimental error of field tests with barley and rice on single unit plats, successive unit plats, and scattered unit plats is discussed, and data giving the standard deviation on the plats and the estimated standard deviation are presented in tabular form. The conclusions reached from these data are that the standard deviation decreases with the size of the plat, that it is smaller with the scattered unit plats than with the successive unit plats, and that the scattered unit plat method is superior to the successive unit plat method in point of sampling.

The author found the probable error on a $\frac{1}{4}$ -acre plat of barley to be about ± 3.3 per cent, and of rice about ± 1.8 per cent. He concludes that the probable error in plats of this size is about ± 2 per cent as contrasted with the results obtained by Hall and Wood (H. S. R., 26, p. 732), from which they calculated the probable error in field experiments to be approximately ± 5 per cent. He attributes this difference to the more intensive cultural methods employed in Japan.

Five methods for sampling a rice crop in the field to estimate the total yield were described and were tested, and the results presented in tabular form. In order to place the results on some basis for comparison, the estimated standard error has been calculated in each case according to the following formula:

$$w = \sigma \sqrt{\frac{1}{300n}}$$

where n is the total number of plants sampled, σ the real standard error, and 300 a constant. From these results the author concludes that either the "diagonal" or "scattered" method of sampling is superior to the other methods tested.

[Report of field crop work], J. M. SCOTT (*Florida Sta. Rpt. 1916*, pp. 25-27).—Fertilizer tests with Japanese cane, velvet beans, and sweet potatoes, variety tests with cowpeas and velvet beans, and field tests with cotton and corn are briefly noted.

The 1915 yield of Japanese cane showed a decrease, as compared with that of 1914, of more than 50 per cent on some plats, while on others the decrease ranged from 10 to 20 per cent. In the spring of 1915 land grown continuously of Japanese cane under varying fertilizer treatments since 1908 was plowed and replanted to cane, using the same fertilizers. The results are interpreted as strongly indicating the advisability of replanting Japanese cane every three or four years. The highest yield, 31.9 tons of green forage per acre, was secured from the plats receiving 84 lbs. of muriate of potash and 224 lbs. of acid phosphate. The lowest yield, 18 tons per acre, was obtained from the plat receiving 112 lbs. of dried blood and 224 lbs. of acid phosphate. Applications of ground limestone failed to show any substantial benefit after the first application in 1909.

Fertilizer tests with velvet beans gave the highest average yield, 658.4 lbs. of pods per acre, with an application of 360 lbs. of Thomas slag, while the lowest yield, 583.9 lbs., was secured from a 400 lb. application of acid phosphate. Untreated checks yielded 616 and 642.8 lbs. per acre, respectively.

An application of 112 lbs. of dried blood, 224 lbs. of acid phosphate, 84 lbs. of muriate of potash, and 2,000 lbs. of ground limestone showed the highest average yield of sweet potatoes, estimated at 269.6 bu. per acre. The lowest yield, estimated at 99.6 bu., was obtained from a plat receiving 112 lbs. of dried blood and 224 lbs. of acid phosphate.

Of the four varieties of cowpeas tested for forage production, Monette S. P. I. No. 1541 was highest with a yield of 1,705.1 lbs. per acre and Brabham second with a yield of 1,577.9 lbs. In seed production Monette S. P. I. No. 1541 yielded 531.7, Brabham 517.3, and S. P. I. No. 27863 258.2 lbs. of seed pods per acre.

Tests with velvet beans included the Yokohama, Osceola, Florida, Chinese, and Wenhalla varieties, which yielded 1,893, 1,304.6, 1,320, 1,229.5, and 856 lbs. of pods per acre, respectively.

The average acre yield of seed cotton amounted to 349.5 lbs. per acre. Selection work with cotton is being continued.

The seed heads of Sumac sorghum grown on the station farm amounted to 1,294.25 lbs. per acre green weight and 1,129 lbs. dry weight. The average heads in green and dry forage amounted to 9,512 and 3,037 lbs. per acre, respectively, based on a 2-acre yield.

[Experiments with field crops in Maine], C. D. WOODS (*Maine Sta. Bul. 26* (1917), pp. 102-120).—Variety and rate-of-seeding tests with oats were continued as previously noted (*E. S. R.*, 35, p. 83), and fertilizer experiments with oats and potatoes reported.

Sixteen varieties of oats were tested at Aroostook farm in 1916, giving an average yield of 61.4 bu. of grain and 8,412 lbs. of straw per acre. Maine 340 was highest, with a yield of 75.6 bu. It also matured from three to six days earlier than Early Pearl and Siberian, which yielded 66.6 and 66 bu. per acre, respectively. The early varieties Kherson and Daubeney, maturing from a week to ten days earlier than the other varieties, yielded only 61.3 and 57.2 bu., respectively.

Eight commercial varieties of oats and ten pure-line selections were tested during 1916 at Highmoor farm. The season is reported as having been very unfavorable for the oat crop. Early Pearl, with a yield of 56.7 bu., was the leading commercial variety tested, while Maine 340, with a yield of 52.7 bu. per acre, was first of the pure-line selections.

In the rate-of-seeding tests with oats the 14-pk. rate again gave the highest yield, 71.3 bu. per acre. The 16- and 20-pk. rates yielded 70.2 and 69.5 bu., respectively, but showed a distinct tendency to lodge.

Fertilizer experiments with oats on the Aroostook farm included a series of plots receiving an application of 500 lbs. of commercial fertilizers each per acre, having 4 per cent nitrogen, 8 per cent available phosphoric acid, and from 0 to 8 per cent potash. Oats were also grown on land seeded to potatoes in 1915 with and without potash. The results indicate that potash is not a limiting factor in oat production in these soils, and that the application of potash the previous year does not affect the oat crop following.

Experiments on the effect of omitting potash fertilization upon the potato crop were continued, with more pronounced effects in favor of potash fertilization than previously observed (E. S. R., 35, p. 34). The average yield for the two years from the plots receiving no potash was estimated to be 111 barrels, and from those plots receiving 8 per cent potash 134 barrels. It is concluded that as little as 45 lbs. of potash per acre will give a profitable increase in the yield of potatoes, at least when grown on sod land, while a profitable yield can be obtained without the use of potash for at least one year.

The comparison of sulphate of ammonia with nitrate of soda as a source of nitrogen for potato fertilization was continued. From the results of three years of experimental work it is concluded that at least two-thirds of the total nitrogen can be supplied in the form of sulphate of ammonia without decreasing the yield. These experiments are to be continued in order to determine the effect of these different substances under different seasonal conditions.

In comparing methods of application of fertilizers to the potato crop it has been concluded that fully as good, if not better, results can be obtained by applying all the fertilizer in the planter. It appeared that up to 1,500 lbs. per acre nothing was gained either by broadcasting before planting or by applying a part at the first cultivation.

Field tests are briefly noted on the use of common salt in fertilizing oats, potatoes, grass, and turnips to liberate the unavailable potash in the soil. Increased yields of turnips were noted, but no benefit was found with the other crops. No appreciable effect of the salt on the soil potash was observed.

Results of breeding experiments, C. B. WILLIAMS (*North Carolina Sta. Rpt. 1916, pp. 16-18*).—Selection and variety tests with cotton, corn, soy beans, and velvet beans are briefly reported.

Cotton Selection No. 29 is deemed the best yielder thus far secured, producing 252 lbs. of seed cotton per acre more in 1915 than the unselected seed and leading in the variety tests at the station farm by 94 lbs. of seed cotton per acre. A uniform strain of cotton was secured at Aberdeen in 1915, which gave a staple $1\frac{1}{2}$ in. in length and compared favorably in yield with the local short-

ample cottons. A strain introduced into Edgecombe County in 1915 produced 55 lbs. of lint per acre more than the prevailing local variety.

Cooperative ear-to-row corn tests resulted in yields estimated to range between 23.1 and 58.7 bu. of shelled corn per acre from selections made the previous fall. The 10 best selections averaged 54.2 bu. while the average yield of all selected seed was 42 bu. per acre.

Mammoth Yellow and Tokyo soy beans are recommended for seed production for the eastern and lower Piedmont sections of the State, while Haberlandt and Wilson are recommended for the upper Piedmont and mountains. Virginia is deemed superior to all varieties tested for hay production in all sections of the State.

Velvet beans have not proved successful in the western portion of the State, while from Wake County eastward the varieties are classed as follows: For hay production, Florida Velvet, One Hundred Day Speckle, Chinese, Wakula, and Yokohama; and for seed production, One Hundred Day Speckle, Wakula, Yokohama, Chinese, and Florida Velvet. One Hundred Day Speckle is deemed best for North Carolina conditions generally.

Daily variation of water and dry matter in the leaves of corn and sorghums, E. C. MILLER ET AL. (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 1, pp. 11-46, pl. 1, figs. 10).—In connection with studies previously cited (*U. S. R.*, 35, pp. 437, 529), the author has determined the daily variation of the water and dry matter content of the leaves of Pride of Soline corn, Iowaallo maize, and Blackhull Kafir corn. A knowledge of the variations of the amount of water in the leaves was expected to throw light on the relative ability of these plants to absorb water from the soil and transport it to regions of loss through transpiration, while a study of the variations of dry matter in the leaves was expected to show the relative power of the plants to manufacture food under different climatic conditions. The experiments were conducted during the summers of 1914, 1915, and 1916 at the Garden City station of the Kansas Experiment Station.

Soil samples for moisture determinations were taken for each foot to a depth of 6 ft. either a few days before or after the experimental work with the leaves. The results of the determinations, together with the wilting coefficient and moisture equivalent for each of the several plants, are reported in tabular form.

Livingston's porous cup anemometers with a coefficient of 74 were employed to determine hourly evaporation. The anemometers were placed 2 ft. from the ground, connected with burettes so that readings could be made to 0.1 cc., and evaporation in cubic centimeters reported in tabular form for the different periods of leaf sampling for each year of the experiment.

Leaf samples, each with an area of 1 sq. cm., were taken every two hours during an experiment from 30 representative plants of each variety. One leaf was chosen on each plant to furnish all the samples desired for a given experiment. The samples were taken by means of a Ganong leaf punch.

Nine experiments were conducted in 1914, two in 1915, and four in 1916. Four of the 1914 experiments extended through the daylight hours only, all others ranging from 24 to 40 hours in length. The amount of water and dry matter for each square meter of leaf were determined every two hours for a total of 22 days and 10 nights, and the percentage of water calculated on both a wet and dry basis. The data obtained are presented in tabular form, expressed graphically, and the results discussed in some detail.

The following summarized statement shows the variation of the water content of the leaves of the plants studied during the three years 1914-1916:

Variation of the water content of the leaves of corn, Kafir corn, and milo maize, 1914-1916, at Garden City, Kans.

Time of day.	Kind of plant.	Loss.			Gain.			Net gain (+) or loss (-).	
		Number of leaves of each.	Average loss of leaf water per square meter of leaf.	Average percentage of loss based on leaf water at beginning of period.	Number of leaves of each.	Average gain of leaf water per square meter of leaf.	Average percentage of gain based on leaf water at beginning of period.	Per square meter of leaf.	Percentage based on leaf water at beginning of period.
			Gm.	Percent.		Gm.	Percent.	Gm.	Percent.
7-9 a. m.	Corn.....	21	4.1	3.5	0	0	0	-4.1	-3.5
	Kafir corn..	13	3.3	2.8	1	3.8	3.2	-3.0	-2.5
	Milo maize..	18	4.2	4.0	3	1.3	1.3	-3.6	-3.4
9-11 a. m.	Corn.....	13	4.8	4.2	2	2.5	2.2	-4.1	-3.8
	Kafir corn..	16	3.9	3.4	1	1.3	1.0	-3.7	-3.4
	Milo maize..	20	2.2	2.1	1	5.2	5.6	-1.9	-1.8
11 a. m.-1 p. m.	Corn.....	15	3.7	3.4	6	2.9	2.4	-2.5	-2.2
	Kafir corn..	14	3.1	2.8	3	4.2	3.6	-2.5	-2.2
	Milo maize..	11	1.9	1.9	7	1.7	1.6	-1.1	-1.1
1-3 p. m.	Corn.....	13	3.1	2.8	10	2.5	2.2	-1.8	-1.6
	Kafir corn..	4	2.5	2.1	13	3.1	2.7	+2.0	+1.7
	Milo maize..	11	3.2	3.1	10	2.6	2.6	-1.7	-1.6
3-5 p. m.	Corn.....	4	2.7	2.3	17	5.7	4.9	+4.6	+4.1
	Kafir corn..	0	0	0	17	4.3	3.6	+4.3	+3.6
	Milo maize..	4	4.1	4.2	17	3.9	3.7	+3.2	+3.6

The average rate of increase of dry matter for each square meter of leaf for corn, Kafir corn, and milo maize during each two-hour period of the day has been estimated as follows:

Average rate of increase of dry matter per square meter of leaf.

Kind of plant.	7-9 a. m.	9-11 a. m.	11 a. m.-1 p. m.	1-3 p. m.	3-5 p. m.
	Gm.	Gm.	Gm.	Gm.	Gm.
Corn.....	2.2	1.1	0.8	0.7	0.9
Kafir corn..	1.7	1.2	.7	1.2	.7
Milo maize..	1.3	1.5	2.2	2.0	.8

The author summarizes his observations and conclusions as follows:

The amount of water in the leaves of milo maize was found to be lower at all times of the day and night than that of corn or Kafir corn leaves at a similar stage of development, while the average water content of these two was practically the same. The water content of the leaves of corn, Kafir corn, and milo maize averaged 118.5, 120, and 107 gm., respectively, for each square meter of leaf during the day (7 a. m. to 7 p. m., inclusive) and 127.9, 132.7, and 115.5 gm., respectively, for the night periods (7 p. m. to 7 a. m., inclusive). The average variation between the maximum and minimum water contents of the leaves from 7 a. m. to 7 p. m. was 13.8, 8.4, and 7.8 gm. for each square meter of leaf of corn, Kafir corn, and milo maize, respectively, and the average range between the maximum water content of the leaves during the night and the minimum amount during the day, 23.8, 25.9, and 21.7 gm., respectively.

Evaporation during the 22 days reached a maximum 18 times between 2 and 3 p. m. and 4 times between 3 and 5 p. m. Two-thirds of the observations for corn and milo maize and nine-tenths of those for Kafir corn showed a minimum water content of the leaves from two to four hours before maximum evapora-

tion was reached, while in the remaining tests the minimum amount of leaf water occurred at the time of maximum evaporation.

On a wet basis the maximum and minimum percentages of water in the leaves showed an average variation during the day of 3.5 for corn, 3.2 for Kafir corn, and 4.5 for milo maize. The average variation between the minimum percentage of water during the day and the maximum during the night was 5.4, 5.9, and 6, respectively. On a dry basis the average difference between the minimum and maximum percentages of water during the day was 39.5 for corn, 31.1 for Kafir corn, and 35.9 for milo maize. The average range between maximum and minimum water content during the night was 37.5, 47.5, and 40 per cent, respectively, while the average range between the minimum percentage of water during the day and the maximum percentage during the night was 67.8, 67.2, and 51.2, respectively.

The average dry weight of a square meter of leaf for all observations was 48.2 gm. for corn, 52.5 for Kafir corn, and 53.2 for milo maize. The average difference between the minimum and maximum amounts of dry matter in the leaves for each square meter during the day was 4, 4.8, and 8 gm. for corn, Kafir corn, and milo maize, respectively. The increase in dry matter began at daybreak and usually reached a maximum between 2 and 5 p. m., the rate of increase during that portion of the day when the climatic conditions were severe being higher for milo maize than for either corn or Kafir corn.

The results are held to indicate that the sorghums, more particularly milo maize, can absorb water from the soil and transport it to leaves more rapidly in proportion to the loss of water from the plant than can corn. As a result of this the sorghums are enabled to produce more dry matter per unit of leaf area under severe climatic conditions than can the corn plant.

Experiments with legume crops under irrigation, J. S. WELCH (*Idaho Sta. Bul. 94* (1917), pp. 14, figs. 5).—Field tests and observations with various legumes under irrigation at the Gooding substation in southern Idaho are noted and briefly discussed.

Rate-of-seeding tests with alfalfa during the period of 1910-1912, inclusive, gave average yields of 4.021, 3.726, 4.364, 3.855, and 3.702 tons per acre, with 20-, 16-, 12-, 8-, and 4-lb. rates, respectively.

A comparison of the corrugation method with the flooding method for irrigating alfalfa showed the former to be far superior for the first season of growth, after which it failed to show any advantage over the latter method. A comparison of different sized streams for the application of irrigation water during 1915-16 gave average yields of cured hay of 4.248, 2.842, and 2.291 tons per acre for streams of 0.3, 0.65, and 1.2 cu. ft. per second, respectively. Tests on the duty of water for alfalfa hay during 1911-1914, inclusive, indicated that for three crops of hay an application of about 2.75 acre-feet per acre gave best results.

For alfalfa-seed production light, frequent applications of water sufficient to maintain a uniform but not excessive soil moisture content were deemed best.

Field tests with red clover indicate that the common is the most important strain, and that grown for hay it requires practically the same treatment as alfalfa. The heaviest yields of seed were obtained from plats clipped late in May. Increased yields of barley, wheat, and oats estimated at 17.57, 10.74, and 9.47 bu. per acre, respectively, were attributed to the plowing under of a red clover crop as a green manure.

Alsike and white clovers are deemed valuable as pasture mixtures, while crimson clover has not proved to be sufficiently hardy for Idaho conditions.

In variety tests with field peas the Amraoti was first, with an average yield of 39.01 bu. per acre for 1912-1915, inclusive. Other varieties have given satisfactory yields. Field peas sown in rows 21 in. apart and cultivated gave an average yield of 32.49 bu. per acre as compared with an average of 38.98 bu. for peas drilled in. The best results with field peas were secured with one irrigation just before blooming, followed by a second application when the peas were forming.

In rate-of-seeding tests with different mixtures of field peas and oats the highest average yield, 3.223 tons of cured hay per acre, was secured from a rate of 70 lbs. of peas and 50 lbs. of oats. An estimated net return of \$39.68 per acre was secured from "hogging off" field peas alone in 1916, while a mixture of three-fourths field peas and one-fourth wheat sown at the rate of 90 lbs. per acre was estimated to give a net return of \$45.20.

Vicia villosa, the White Navy field bean, and the horse bean have proved valuable as forage crops. Soy beans and cowpeas have not proved hardy.

The management of irrigated grass pastures, J. S. WELCH (*Idaho Sta. Bul. 95* (1917), pp. 17, figs. 4).—Results at the Gooding substation previously noted (E. S. R., 32, p. 628) are reviewed, together with additional data secured from grazing tests and observations during 1915-16. Certain important phases of pasture management under irrigation conditions are emphasized.

Experiments with small grains under irrigation, J. S. WELCH (*Idaho Sta. Bul. 95* (1917), pp. 24, figs. 5).—The results of variety and irrigation experiments with spring and winter wheat and barley and spring oats at the Gooding substation, conducted in cooperation with the Irrigation Investigations of the U. S. Department of Agriculture, are reported for the period of 1909-1916, inclusive.

The soft, white, spring wheats are considered best adapted for growth under irrigation. The Dicklow, with a 6-year average yield of 46.1 bu. per acre, was deemed the best spring wheat variety, and Jones Fife and Turkey Red, with 2-year average yields of 53.6 and 52.4 bu., respectively, the best winter varieties. Although drought-resistant, the durum wheats are not recommended for average irrigation conditions.

The irrigation experiments with spring wheat indicated that the highest yields were secured from one irrigation in each of three successive stages of growth and amounted to an average of 43.9 bu. per acre for the period of 1911-1916, inclusive. One irrigation in the first and second stages each gave an average yield of 43.5 bu., and one irrigation in the first stage only, an average of 33.6 bu. per acre. When irrigation was withheld until the third stage the average yield was 22.7 bu., and it was considered as of no value to the crop. It is recommended that if but one irrigation can be made it be applied just before the first jointing stage of growth.

Duty-of-water experiments with spring wheat from 1910-1916, inclusive, indicated that a total application of not more than 1.25 acre-feet of water per acre gave the best results. For winter wheat production one irrigation of slightly less than 0.75 acre-foot of water per acre applied just before heading was deemed sufficient from results secured in tests conducted in the years 1910, 1911, and 1912.

In variety tests with spring barleys Trebi, with 95.5 bu., Beldi No. 1209, with 87.3 bu., and Sandrel, with 82.9 bu. per acre gave the highest yields for the 6-rowed types; Bohemian, with 84.21 bu., and Horn, with 81.65 bu. for the 2-rowed types; and Bureka, with 63.4 bu. for the hull-less type.

In irrigation tests with spring barley a study was made of the influence of different sized streams, employing 1.2, 0.65, and 0.3 cu. ft. per second. The tests were conducted during 1915-16, and the average yields were 54.7, 55.9,

and 49.2 bu. per acre, respectively. Duty-of-water experiments with spring barley extending over the period of 1910-1914, inclusive, indicated the use of approximately 1.5 acre-feet of water per acre as sufficient.

The Utah and Tennessee winter barleys yielded 60.7 and 60.3 bu. per acre, respectively, for a 2-year average. Duty-of-water experiments with winter barley extending over the 3-year period of 1913-1915 gave the best results with one irrigation of about 0.43 acre-foot of water per acre applied just before heading.

The leading varieties of oats included Swedish Select, Wisconsin Pedigree No. 1, and Silver Mine, with average yields of 96.6, 96.5, and 96 bu. per acre, respectively.

Duty-of-water experiments with oats indicate that the oat crop requires approximately 1.75 acre-feet of water per acre.

Yields of winter grains in Illinois, W. L. BURLISON and O. M. ALLEN (*Illinois Sta. Bul.* 201 (1917), pp. 96-110, figs. 3).—Field tests with winter varieties of wheat, rye, and barley conducted at DeKalb (DeKalb Co.), Urbana (Champaign Co.), and Fairfield (Wayne Co.) are reported and briefly discussed. The results of the wheat variety tests conducted at Cutler (Perry Co.) and previously noted (E. S. R., 19, p. 1035) are summarized, and tests with rye, barley, emmer, and oats reported for the winter of 1915-16. The data are presented in tabular form.

The winter wheat variety tests at DeKalb were begun in 1907 and Dawson Golden Chaff employed as a standard of comparison. Turkey Red is deemed the principal high-yielding variety for northern Illinois, while other high-yielding varieties grown for a minimum of three years include Turkey 9-233, Malakoff 458, Minnesota Reliable, Wheedling 5-464, Kharkof, and Malakoff, with average yields of 37.2, 36.7, 36.1, 35.2, 32.6, and 31.4 bushels, respectively. Turkey Red has given a 7-year average yield of 35.4 bu. per acre.

Winter barley all winterkilled. Average yields of 55.5 and 47 bu. per acre, respectively, were secured from four tests each of Petkus winter rye and Wisconsin Pedigree rye.

Variety tests with winter wheat at Urbana were begun in 1904, using Turkey Red as a standard variety. The average yields of the leading varieties tested five years or more were as follows: Turkey Red 42.4 (12 years), Malakoff 42, Fultz 42.1, Hungarian 39.7, Pesterboden 41.8, Beloglina 40.4, Kharkof 42.6, and Dawson Golden Chaff 39.5 bu. per acre. Other promising strains for central Illinois are Turkey Hybrid 509 and Dawson Golden Chaff 9-225.

Tests with winter wheat at Fairfield were begun in 1906, using Fulcaster as a standard variety. The following varieties have given the highest average yields on a percentage basis for a minimum of three years: Fulcaster, Economy, Missouri Pride, Indiana Swamp, Wheedling, Harvest King, Rudy, and Poole, with 15.9 (10 years), 16.9, 15.8, 14.9, 14.5, 14.3, 12.3, and 12 bu. per acre, respectively. Fulcaster was outyielded several years by Economy, Wheedling, Missouri Pride, and Harvest King. The hard wheats such as Turkey Red and Kharkof did not prove to be adapted to southern Illinois conditions.

The following results were secured with winter grain at Cutler in 1916: Wisconsin Pedigree rye 43.4 bu., Wing Black rye 46.8 bu., Salzer winter barley 22.7 bu., Michigan winter barley 17.5 bu., and Winter emmer 52 bu. Winter oats did not prove hardy.

The characteristics of the winter wheat varieties tested at DeKalb, Urbana, and Fairfield are noted in tabular form.

Bean culture, V. C. BAYANT (*California Sta. [Pub.], 1917*, pp. 2).—A brief popular outline of the cultural practices deemed best for bean production in California.

Dried bean production in Illinois. C. E. DUBST (*Illinois Sta. Circ.* 201 (1917), pp. 8).—A general discussion of the production and harvesting of beans for drying as human food, together with a brief note on insects and diseases.

Field bean production. R. W. DE BAUN (*New Jersey Sta. Circ.* 70 (1917), pp. 4).—The methods for production of field beans in New Jersey are briefly discussed.

Studies of variation and correlation of weight and sugar content of beets, especially sugar beets. W. OETKEN (*Landw. Jahrb.*, 49 (1916), No. 1, pp. 1-163, figs. 4).—The author outlines the object of his investigations and describes the material used and the methods employed in connection with a series of experiments previously noted (*E. S. R.*, 35, p. 640). A number of formulas are presented and explained for determining the mean, the standard of deviation, the coefficient of variation, regression, the correlation coefficient, the excess, etc.

The variability in weight and sugar content was studied in respect to the individual and to a series of individuals. Considerable data are presented in tabular form and discussed in detail.

A list of 75 articles comprising the literature cited is appended.

Corn. F. APP (*New Jersey Sta. Circ.* 69 (1917), pp. 7).—The advantages of an increased corn acreage under present food conditions are briefly discussed and the field practices employed in corn production in New Jersey outlined.

Varieties of cotton, 1916. W. E. AYRES (*Arkansas Sta. Bul.* 129 (1917), pp. 3-32, fig. 1).—Extensive variety tests with cotton at Scotts, Mena, and Fayetteville and cooperative tests throughout the State are reported, with considerable tabulated data.

The highest-yielding varieties at Scotts were Cleveland, with 946.2 lbs. of lint per acre, and Cook No. 920, with 813.8 lbs. per acre. At Mena Half and Half was first, with 265.4 lbs. of lint, and Arkansas Trice second, with 225.4 lbs. per acre. Brief descriptive data are submitted for the varieties tested at Fayetteville.

The recurving of mile and some factors influencing it. A. B. CONNER and R. E. KARPEN (*Texas Sta. Bul.* 204 (1917), pp. 3-39, figs. 13).—Experiments were conducted by the authors during 1916 at Lubbock, Tex., pertaining to the recurving, or "goosenecking," of milo maize, which is deemed undesirable on account of the difficulty of harvesting the crop with machinery and the reduction in yield through loss of heads during the early stages of growth. Some conclusive data are presented on the anatomy of the milo maize plant and variation in anatomy of both milo maize and Kafir corn plants under different environmental conditions. No definite conclusions are drawn as to the fundamental causes of recurving, although a number of the factors which heretofore were considered responsible for the phenomenon have been eliminated and evidence advanced to indicate that recurving is due to the structure and development of the upper leaf sheath.

Considerable tabulated data are presented and discussed in detail. The studies are to be continued in the hope of obtaining a proper basis for the selection of strains having erect heads. The observations for the season of 1916 may be summarized as follows:

Tallness or dwarfness in the same strain was a result of the lengthening or shortening of the internode. No apparent difference was observed in the tenderness of the peduncle of different grain sorghums at similar stages of growth. Dwarfness was associated with a high percentage of erect heads, while tallness was attended by a high percentage of pendant heads. Rapid growth was conducive to tallness and slow growth to dwarfness.

The removal of a vertical section of the back of the upper leaf sheath always resulted in a complete recurving of the peduncle in the direction of the open-

64. The upper leaf is attached to its sheath at an angle of approximately 45°, and the long side of the sheath first begins inrolling. Tall plants showed a long inroll of the upper sheath as compared with dwarf plants, that character being also associated with a large number of pendant heads.

Root pruning and a consequent limitation of the food supply increased the number of erect heads and decreased the number of pendant heads. Furthermore, a limitation of the moisture and food supply of the individual plants by reducing the feeding area per plant resulted in an increased number of erect heads and a decreased number of pendant heads.

Measurements of internode and sheath lengths in both milo maize and Kafir corn showed that while the internode lengths varied widely under different environmental conditions, the sheath length remained quite stable. A variation of the internode length without a corresponding change in the sheath length resulted in an overlapping of the internode in varying degrees when the same plant was grown under different conditions. Long overlapping of the sheath probably furnished support to the stem and the peduncle, while a short overlapping supplied correspondingly little support. The removal of the inrolled sheath tip before any part of the head appeared resulted in an increased percentage of erect heads. It appeared that in milo maize the tightly inrolled upper leaf sheath tip influenced the position of the head.

The culture of early potatoes under glass (*Jour. Bd. Agr. [London]*, 23 (1917), No. 10, pp. 976-978).—This is a brief general discussion of the production of early potatoes under glass. Several early and second early varieties are recommended for use, and directions are given for the preparation of the soil, planting, and the care of the house during the growing season.

The morphology and development of transplanted rice, B. MARCARELLI (*Gior. Riscott.*, 6 (1916), Nos. 13-14, pp. 211-222; 22, pp. 341-347; 23, pp. 357-364; 24, pp. 372-378, figs. 21).—The morphology and development of transplanted rice is compared with that of rice seeded in the field. The author discusses in particular the morphological effects of transplanting on the root system, the aerial portions of the plant, stem development, and development of the rachis.

The increased development following transplanting is illustrated.

Studies of the volume weight of hulled rice grains, M. KONDO (*Ber. Ohara Inst. Landw. Forsch.*, 1 (1916), No. 1, pp. 1-26, pls. 2).—This reports studies with rice to determine the correlation between volume weight and such grain characteristics as size and form of kernel, water content, mixture of whole and broken kernels, impurities, etc., since volume weight is a recognized factor in determining the value of rice on the Japanese market.

Similar studies with barley, wheat, rye, and oats are noted.

Considerable data are presented in tabular form and graphs drawn to illustrate the correlations studied.

In studying the relationship between the water content of hulled rice and its volume weight, the experiments included drying by the heat of the sun, drying in a desiccator with sulphuric acid or calcium chlorid, and drying in an oven. A fourth experiment was planned to study this relationship in hulled rice kernels which had been dried by the sun's heat before hulling.

The volume weight of hulled rice kernels is influenced by different factors, the relationship between volume weight and these factors being as follows: Factors causing an increase in volume weight were smooth seed coat; thick, round, short-elliptical kernels; the addition of small kernels; the mixing of large and small kernels of the same kind; and sun or oven drying of the seed before hulling. Factors which caused a decrease in volume weight were a rough seed coat; long, thin kernels; broken shrunken kernels, straw, chaff,

etc.; drying by the sun's heat or by means of chemicals; and the absorption of water. The one factor which exerted no definite influence was size of kernel.

The author concludes that in view of the complex nature of these correlations it is practically useless to attempt a determination of the quality or moisture content of rice by means of volume weight.

Rhodes grass, P. H. ROLFS (*Florida Sta. Bul. 138 (1917), pp. 182-190, fig. 1*).—The value of Rhodes grass for hay and pasture in central and southern Florida has been demonstrated by field tests at the station since 1909, and its use is recommended on well-tilled, moist lands in regions where the winter temperatures do not go below 23° or 22° F.

Sugar beet culture, R. L. STEWART (*New Mexico Sta. Bul. 107 (1917), pp. 30, figs. 7*).—The production of sugar beets in New Mexico is discussed in detail. The results of rather extensive experiments begun in 1916 are reported as planned to study the best cultural methods and the effect of low humidity and high temperature upon the yield and sugar content of the beets and the purity of the juice.

The experimental work was conducted on light sandy, silt loam, and moderately heavy adobe soils. Plantings were made on all sandy and adobe soils in December, January, and February, and on the silt loam beginning with March 15 and at 15-day intervals for the remainder of the season. Irrigation consisted of flooding after planting, furrowing after planting, or planting in a moist seed bed. The best stands were secured from plantings made May 1, while little difference was noted in the stands under different methods of irrigation.

Analyses of samples from the different plats gave an average of 18.1 per cent sugar and 79.1 per cent purity. The maximum sugar content was 20.3 per cent and the maximum purity 94.2 per cent.

The results of the first year's test indicate that beets grown on heavy soil are lower in sugar content and in purity than those grown on light soils.

The tillering of winter wheat, A. E. GRANTHAM (*Delaware Sta. Bul. 117 (1917), pp. 3-118, figs. 18*).—An extensive study of tillering of winter wheat is reported in an effort to determine to what extent certain factors affected the rate of tillering and, through tillering, the yield of grain. The studies included an investigation of (1) the effects of environmental factors on tillering, such as time, rate, and depth of seeding and fertilization, (2) of the relation of heredity to tillering, including the relation of variety to tillering, and the inheritance of tillering, and (3) a study of the number of tillers in relation to length of culm, length of spike, yield per plant, yield per spike, and quality of grain. Considerable tabulated data are presented, discussed in detail, and may be briefly summarized as follows:

The time of seeding directly influenced tillering, early seeding being accompanied by a higher rate of tillering than late seeding. The yield per spike of high-tillering plants usually exceeded that of low-tillering plants.

Rate of seeding influenced tillering in that the thicker the seeding the fewer the tillers per plant. Close seeding resulted in earlier maturity and shorter spikes. A high seeding rate lessened the number of tillers, the length of culm and spike, and the yield of grain in smooth wheats to a greater extent than in bearded wheats.

Nitrogen and phosphoric acid appeared to stimulate tillering, while potash had little or no effect. Wheat was observed to tiller equally as well when sown late on fertile soil as when sown earlier on thin soil.

The capacity for tillering appeared to be a varietal characteristic, varieties differing considerably in this respect. Bearded wheats as a class tillered more freely than smooth wheats, the environmental factors appearing to influence the

rate of tillering in the former to a less extent. A tendency was noted for high tillering mother plants to produce a larger proportion of plants with a larger number of tillers than the average, but the inheritance of tillering as indicated by the performance of individual plants was not marked.

Increased yields per spike accompanied an increase in the number of tillers per plant up to 4 or 5 tillers, beyond which the yield was more or less uniform. Low tillering plants of a variety produced smaller yields per spike and grain of poor quality. Within a variety under similar conditions of planting the quality of grain was correlated to some extent with the number of tillers per plant. Varieties with coarse, stiff straw did not tiller so freely as those with finer, more pliable straw. Depth of planting did not appear to affect materially the number of tillers per plant. The improved quality of grain used for seed, as indicated by size, plumpness, and weight, favored a higher rate of tillering.

Regulations and instructions relating to the labelling, inspection, and analysis of seeds in New Jersey, J. P. HELYAR (*New Jersey Stat. Circ. 66 (1917)*, pp. 3-10).—This outlines the rules and regulations promulgated by the station for the enforcement of the New Jersey seed law of 1916.

The seed situation, J. P. HELYAR (*New Jersey Stat. Circ. 72 (1917)*, pp. 3-7).—This is a brief consideration of the most feasible means for meeting the situation in respect to agricultural seeds for the 1918 planting.

HORTICULTURE.

Gardening.—A complete guide, H. H. THOMAS (*London and New York: Cassell & Co., Ltd., 1917*, pp. [8]+152, figs. 78).—A guide to the culture of ornamentals, fruits, and vegetables, both in the open and under glass.

The beginner's gardening book, H. H. THOMAS (*London and New York: Cassell & Co., Ltd., 1917*, pp. 80, figs. 18).—A small popular treatise on ornamental and kitchen gardening.

The manuring of market garden crops, with special reference to the use of fertilizers, F. T. SHUTT and B. L. EWSLEY (*Canada Expt. Farms Bul. 32, 2 ser. (1917)*, pp. 36).—This bulletin deals briefly with some of the important features of market gardening in Canada, with special reference to the selection and use of fertilizers and fertilizing materials. Data on fertilizer experiments with vegetables conducted in 1915 are appended. The results as a whole indicate the economic advantage of a medium application of manure with suitable commercial fertilizers as compared with the use of a large quantity of manure alone.

Possibilities of the fall vegetable garden, C. E. DUBST (*Illinois Sta. Circ. 209 (1917)*, pp. 8, fig. 1).—This circular deals with vegetables which can be made available for fall use. Consideration is given to vegetables planted in early spring and which are capable of surviving hot dry weather, vegetables planted in late spring and early summer, and quick maturing vegetables planted in late summer or early fall especially for fall use.

Variety tests of potatoes, tomatoes, cabbage, and other vegetables, T. H. WHITE (*Maryland Sta. Bul. 204 (1917)*, pp. 231-262, figs. 5).—This bulletin contains the hitherto unpublished notes and records of vegetables that have been tested at the station during the past ten years.

Potatoes and root crops, H. H. THOMAS (*London and New York: Cassell & Co., Ltd., 1917*, pp. 80, figs. 23).—A small popular treatise on the culture of potatoes and other garden root crops.

Tomatoes and salads, H. H. THOMAS and F. R. CASTLE (*London and New York: Cassell & Co., Ltd., 1917*, pp. 79, figs. 27).—A small popular treatise on the culture of tomatoes and various salad plants.

Harvesting and storing vegetables for home use, J. J. GARDNER (*Colorado Sta. Bul. 252 (1917), pp. 3-7, figs. 3*).—Suggestions are given relative to time of planting and harvesting with reference to storing vegetables, together with directions for storing home supplies of the more common vegetables.

Commercial onion culture in Idaho, C. C. VINCENT (*Idaho Sta. Bul. 97 (1917), pp. 3-16, figs. 9*).—This bulletin embodies the results of variety and cultural tests conducted at the station during the last three years, together with the cultural methods followed by the largest and most successful onion growers in the State.

Studies on the dying out of pepper vines in the Dutch East Indies.—III, Pepper cultivation in the Lampong district, A. A. L. RUTGEES (*Dept. Landb. Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 2? (1916), pp. 65, pls. 14*).—This is the third report (*E. S. R.*, 35, p. 835) on a study of the causes leading to the dying out of pepper vines in the Dutch East Indies.

The author concludes in substance that the dying out prematurely can not be explained by the action of insect and fungus troubles but is rather to be attributed to the general state of cultivation. The indications are that with proper methods of tillage, manuring and other cultural measures peppers may be successfully grown on soils where they have been regularly dying out prematurely.

Report on the Government Horticultural Gardens, Lucknow, for the year ended March 31, 1917, H. J. DAVIES (*Rpt. Govt. Hort. Gardens Lucknow, 1917, pp. [6]+10*).—A brief statement relative to the condition of various fruits and other economic plants grown at the gardens, including a financial statement for the year.

Fifteenth annual report of the State nursery inspector, H. T. FERNALD (*Agr. of Mass., 64 (1916), pt. 1, pp. 69-97, pls. 4*).—A report of activities during 1916, with special reference to the inspection of nursery stock for the detection and control of the gipsy and brown-tail moths and white pine blister rust.

Factors governing fruit bud formation, B. T. P. BARKER and A. H. LEES (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1916, pp. 46-64, figs. 4; Jour. Bath and West and South. Counties Soc., 5, ser., 11 (1916-17), pp. 171-191, figs. 4*).—A discussion of various factors affecting fruit bud formation, including a summarized report on long-continued pruning investigations with several varieties of apples conducted at the Agricultural and Horticultural Research Station of the National Fruit and Cider Institute, Long Ashton, Bristol.

Thus far no definite conclusions are reached relative to the direct effect of pruning on fruit bud formation. The evidence secured indicates that both heavy and light winter pruning have given practically the same number of laterals and fruit buds, although these were distributed differently on the trees, the light pruned trees showing a greater amount of growth but much more bare wood.

A study of meteorological conditions prevailing at Long Ashton led the authors to conclude that any results secured from pruning are of only a local value and that the question of fruit bud formation should be investigated with the idea of determining the ultimate cause. Among the factors to be studied in continuing the work are excess of water in the soil, deficiency of water in the soil, the effect of artificial manures, light, and shade.

Miscellaneous notes on experiments in fruit culture, B. T. P. BARKER, A. H. LEES, and G. T. SPINKS (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1916, pp. 71-73; Jour. Bath and West and South. Counties Soc., 5, ser., 11*

(1916-17), pp. 196-198).—The notes here given deal with the progress being made in fruit-breeding investigations at Long Ashton, Bristol, experiments in planting different aged plum trees and the influence of stock on fruit trees. Thus far no definite conclusions have been drawn.

Methods of handling basket fruits, E. SMITH and J. M. CREELMAN (*Canada Dept. Agr., Dairy and Cold Storage Branch Bul. 52* (1917), pp. 13, figs. 10).—The methods here described are based primarily on data obtained in the operation of the Dominion precooling and experimental fruit-storage warehouse at Grimsby, Ont.

A systematic study of Iowa apples, L. R. HARTILL (*Trans. Iowa Hort. Soc., 51* (1916), pp. 162-248).—A paper on this subject prepared for the Iowa State College and State Horticultural Society, and comprising a descriptive list of the more important varieties of apples grown in Iowa. A list of cited literature is included.

Fertilizer experiments on apple trees at Highmoor Farm, C. D. WOODS (*Maine Sta. Bul. 260* (1917), pp. 99-102).—A brief statement of progress made on long-continued experiments being conducted by the station.

Experiments to determine the value of highly nitrogenous fertilizers as a means of forcing trees into bearing have thus far shown no differences that could be attributed to the additional nitrogen in the fertilizer. Experiments conducted since 1912 appear to confirm partially the results secured at the New York State Station in which the use of fertilizers did not materially affect the yield and growth of apple trees (E. S. R., 25, p. 643). In the present investigation no differences could be observed between the trees fully fertilized, those partially fertilized, and those not fertilized at all during the past three years. On the other hand, the limited data available relative to yield of these trees indicate larger yields on the fertilized plats and a consistent increase with the amount of fertilizer applied. The experiment is to be continued for a number of years.

Winter v. summer pruning of apple trees, C. C. VINCENT (*Idaho Sta. Bul. 8* (1917), pp. 28, pls. 2, figs. 23).—This bulletin gives the results secured for a period of 11 years in a comparative test of winter and summer pruning. The four varieties included in the test were Jonathan, Rome, Grimes, and Wagener. The winter-pruned trees received a moderate annual pruning during the dormant season from the time the trees were planted in 1905 until the present time. Similar pruning in the summer-pruned plat took place after the terminal growth had stopped for the year. A complete record of the yields of each individual tree in both plats is given from the time the trees commenced bearing until the present time. Observations were also made on color and growth performance.

On the basis of the total production for the first seven crops summer pruning has produced the greatest yield in all varieties. Color in the three red varieties was intensified by summer pruning. As determined by both color and yield, the crop value per acre under summer pruning as compared with winter pruning shows an average gain of \$52.33 for Jonathan, \$53.64 for Rome, and \$30.69 for Wagener. In some cases summer pruning has hastened the bearing of the young trees. Summer pruning increased the average terminal growth somewhat but tended to check the total wood growth slightly. The average diameter of the tree trunks in the winter-pruned plat was somewhat larger. The experiment as a whole shows that thinning has a direct relation to pruning and crop production.

Field experiments in spraying apple orchards, B. S. PICKETT ET AL. (*Illinois Sta. Bul. 185, adv.* (1916), pp. 12, figs. 4).—A popular edition of Bulletin 185, previously noted (E. S. R., 35, p. 39).

Modern methods of packing apples. A. H. FLACK and P. J. CAREY (*Canada Dept. Agr., Fruit Branch, Fruit Comr. Ser. Bul. 2* (1917), pp. 62, figs. 57).—This bulletin gives instructions for packing apples in boxes and barrels, the subject matter being largely a revision of previous information on the subject (*E. S. R.*, 18, p. 741).

Preliminary report on apple-packing houses in the Northwest. W. M. SCOTT and W. B. ALWOOD (*U. S. Dept. Agr., Off. Markets and Rural Organ. Doc. 4* (1917), pp. 31, figs. 9).—This comprises a preliminary report on an investigation conducted in the States of Washington and Oregon during the apple packing season of 1916, with reference to the handling of apples from the orchard to and through the packing house and into the cars ready for shipment to market.

The subject matter is presented under the general headings of community packing houses, community packing-house equipment, packing-house organization and personnel, a suggested floor unit, some of the details of operation, and the operations in two typical houses.

Plum growing in Maryland. F. S. HOLMES (*Maryland Sta. Bul. 207* (1917), pp. 295-326).—This bulletin presents information relative to the status of the plum growing industry in Maryland and gives the results with varieties tested at the station, together with brief suggestions on orchard management, picking, packing, and marketing.

Profitable small fruits. H. H. THOMAS (*London and New York: Cassell & Co., Ltd., 1917*, pp. 80, figs. 25).—A popular treatise on the culture of strawberries and bush fruits.

The strawberry in North America. S. W. FLETCHER (*New York: The Macmillan Co., 1917*, pp. XIV+234, figs. 26).—A companion work to the author's treatise on strawberry growing (*E. S. R.*, 37, p. 42), and dealing mainly with the origin and history of the North American type of strawberries, including information relative to the improvement of strawberries by breeding and the development of commercial strawberry growing. A list of breeders since 1854 is given.

Soil influence on the composition of strawberries. C. T. GIMINGHAM (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1916*, pp. 65-70; *Jour. Bath and West and South. Counties Soc.*, 5. ser., 11 (1916-17), pp. 191-196).—The results secured with two varieties of strawberries as grown on several different types of soil in the three years, 1914 to 1916, at Long Ashton, Bristol, are here presented.

Among the general conclusions thus far deduced it was found that the two varieties tested show a marked variety distinction in respect to degree of acidity. As to sugar content seasonal influence appears to outclass other factors. With one or two exceptions no soil effect was sufficiently pronounced in the trials to show itself in the presence of the other factors concerned.

The study is to be continued.

New or noteworthy tropical fruits in the Philippines. P. J. WESTER (*Philippine Agr. Rev. [English Ed.]*, 10 (1917), No. 1, pp. 8-23, pls. 9).—In continuation of previous papers (*E. S. R.*, 34, p. 639) the author describes and gives notes on a number of tropical fruits which have been tested at the Lamas Experiment Station.

Report on manurial experiments (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Dominica, 1916-17*, pp. 45-58, pl. 1).—This is the customary progress report on manurial experiments with cacao and limes in Dominica (*E. S. R.*, 36, p. 141). The data secured on the various plats are presented in tabular form and discussed. Work on the lime plats was interfered with by hurricanes in 1916 and the experiments have been reorganized. The results to date are similar to those previously noted.

Citrus experimental grove, S. E. COLLISON (*Florida Sta. Rpt. 1916, pp. 115-118*).—In continuation of previous reports (E. S. R., 35, p. 839) measurements are given showing the average gain in diameter of trees from June, 1909, to June, 1916, growing on the various fertilizer plats in the citrus experimental grove. The lime requirements as studied for each plat are also presented in tabular form.

The data secured show that the acidity of the plats varies from season to season, being greatest in summer and least in winter. The greater increase in acidity during the summer is attributed to the increased decay of vegetable matter. Plats receiving strongly alkaline materials, such as lime, limestone, and hardwood ashes were alkaline in reaction, and those receiving mildly alkaline materials such as Thomas slag and nitrate of soda showed a decrease in acidity. The use of phosphoric acid from floats has not served to decrease the acidity of the soil.

Do fertilizers influence the composition of oranges? H. J. WEBBER (*Cal. Citrogr., 2 (1917), No. 6, pp. 17-19*).—A brief analysis of experiments previously reported by H. D. Young (E. S. R., 36, p. 642).

Standards of maturity for the Washington navel orange, E. M. CHACE (*Mo. Bul. Com. Hort. Cal., 6 (1917), No. 8, pp. 325-330*).—The substance of this article has been noted from another source (E. S. R., 37, p. 345).

Some notes on frost protection in orange groves, R. S. VAILE (*Cal. Citrogr., 2 (1917), No. 6, pp. 10, 11, 16*).—A paper on this subject read at the Orange Show Convention, in which the author reviews the work of various citrus associations and individual growers in protecting groves from frost and makes some deductions relative to the value of frost-protective methods.

It is concluded in brief that although it is entirely possible to protect orange groves against frost it may or may not be profitable, depending upon the size of the crop, amount of actual risk, and amount of protection necessary for any particular grove. It is believed that more attention should be given to the adding of heat units than to the prevention of radiation by the formation of a cloud of smoke.

Preventing frost damage in transit, A. W. MCKAY (*Cal. Citrogr., 2 (1917), No. 6, pp. 4, 5, 17, figs. 4*).—The results of experiments conducted by the U. S. Department of Agriculture during two seasons to determine means of preventing frost injury to citrus fruits in transit are here reported.

Effect of different methods of transplanting coffee, T. B. McCLELLAND (*Porto Rico Sta. Bul. 22 (1917), pp. 11, pl. 1*).—This bulletin reports the result of a trial test of different methods of transplanting coffee, shows the advantages and disadvantages of each method, and gives suggestions relative to the correction of bad practices.

Briefly stated, the test shows that the transplanting of moderately large coffee seedlings, either from or into a heavy clay soil, should unquestionably be done with the roots still incased in the soil in which they grew.

A preliminary report on some breeding experiments with foxgloves, E. WARREN (*Biometrika, 11 (1917), No. 4, pp. 303-327*).—A discussion of the results secured in a number of first generation crosses.

FORESTRY.

Second biennial report Nebraska Forestation Commission, C. RORDE, A. H. MITZGER, and W. BALL (*Bien. Rpt. Nebr. Forestation Com., 2 (1916), pp. 19*).—This report contains recommendations and outlines of proposed legislation dealing with forestry in Nebraska.

Report of the State forester and firewarden, C. P. WILBER (*Rpts. Dept. Conserv. and Develop., N. J., 1916, pp. 49-84, pls. 9, figs. 2*).—A brief statement of activities during the year, including a description of the forests of the State forest reserves and detailed information relative to fire protective work.

Report of the chief forest firewarden for the year 1916, G. H. WIET (*Penn. Dept. Forestry Bul. 16 (1917), pp. 123, pls. 3, figs. 3*).—A report on forest protective measures in Pennsylvania during 1916, including data on forest fires for the year.

Report of the forest branch of the department of lands for the year ended December 31, 1916 (*Rpt. Forest Branch Dept. Lands, B. C., 1916, pp. 55, figs. 2*).—This report deals with the development of markets for British Columbia lumber, together with statistics on sawmill operations, lumber cut, timber sales, fire protection, and miscellaneous work conducted during 1916.

French forests and forestry.—Tunis, Algeria, Corsica, T. S. WOOLSEY, JR. (*New York: John Wiley & Sons, Inc., 1917, pp. XV+238, figs. 20*).—The author here presents the results of a study of the more important phases of forest practice in Corsica, Algeria, and Tunis and a translation of the Algerian forest code of 1903. A subsequent work will be descriptive of methods employed in the forests in France proper. In presenting the subject matter as a whole the aim has been to set forth the essentials of method which may be applied directly in the United States or which may be indirectly of value to English-speaking foresters.

Report on forest operations in Switzerland (*Rap. Dépt. Suisse Int., 1916, pp. 1-12*).—The usual report (*E. S. R., 35, p. 543*) relative to the administration and management of State, communal, and private forests in Switzerland, including data on forest products, revenues, expenditures, etc., in 1916.

Annual progress report of forest administration in the United Provinces for the forest year 1915-16, H. G. BILLSON (*Ann. Rpt. Forest Admin. United Prov., 1915-16, pp. 27+LXX+71*).—The usual report relative to the administration and management of the State forests in the United Provinces. All important data relative to alterations in forest areas, forest surveys, working plans, miscellaneous work, yields in major and minor forest products, revenues and expenditures, etc., are appended in tabular form.

Progress report of forest administration in the Jammu and Kashmir State for the year 1915-16, B. O. COVENTRY (*Rpt. Forest Admin. Jammu and Kashmir [India], 1915-16, pp. 11+26+LV*).—A report similar to the above on the administration and management of the State forests in Jammu and Kashmir State.

Progress report of forest administration in Coorg for 1915-16, H. TIREMAN (*Rpt. Forest Admin. Coorg, 1915-16, pp. [4]+11+13*).—A report similar to the above, relative to the administration and management of the State forests of Coorg for the year 1915-16.

Administration report of the forest circles in the Bombay Presidency, including Sind, for the year 1915-16 (*Admin. Rpt. Forest Circles Bombay, 1915-16, pp. 11+172+6*).—A report similar to the above relative to the administration and management of the State forests of the Northern, Central, Southern, and Sind Circles in the Bombay Presidency for the year 1915-16.

Notes on the principal timbers of Queensland (*Dept. Pub. Lands, Queensland, Forestry Bul. 2 (1917), pp. 20*).—Notes are presented on the more important timbers of Queensland with reference to their distribution, general characteristics, uses, strength, and durability.

Georgia forest trees (*Forest Club Ann., Ga. State Forest School, 1917, pp. 69, figs. 70*).—A handbook describing the coniferous and hardwood trees of Georgia. A key to the hardwoods is included.

Reproduction in the coniferous forests of northern New England, B. MOORE (*Bot. Gaz.*, 64 (1917), No. 2, pp. 149-158).—A paper on this subject delivered at the meeting of the Ecological Society of America in New York City in December, 1916, in which the author gives the results of an investigation undertaken to determine the factors governing the reproduction of the more important coniferous trees in the forests of northern New England. A bibliography of literature cited is included.

Growth study of planted trees, H. DORR, JR., and W. A. BOAG (*Forestry Ann. [Mich. Agr. Col.]*, 2 (1917), pp. 37, 38).—A table is given showing the growth performance of various hardwood species planted in 1909 in the forest nursery of the Michigan Agricultural College.

Frustum form factor volume tables for sugar maple, E. G. HAMLIN (*Forestry Ann. [Mich. Agr. Col.]*, 2 (1917), pp. 14-18, fig. 1).—The tables here presented were prepared with a view to determining the feasibility and accuracy of the frustum form factor method in preparing volume tables. The data were secured in Wexford County, Mich., during 1915 and 1916.

A study of breakage, defect, and waste in Douglas fir, E. J. HANZLIK, F. S. FULLER, and E. C. ERICKSON (*Univ. Wash. Forest Club Ann.*, 5 (1917), pp. 32-40, fig. 1).—A short study was made in the spring of 1916 to secure data upon breakage, defect, and waste in logging Douglas fir timber. The results are here presented in tabular form and are supplemented by a report on breakage in Douglas fir timber as observed in three typical logging camps during 1915.

On the influence of the age of the trees on the quality of the rubber, O. DE VRIES (*Arch. Rubbercult. Nederland. Indië*, 1 (1917), No. 3, pp. 169-177).—A number of special experiments were conducted to determine the influence of the age of rubber trees on the quality of the rubber.

The results in general show that the tensile strength of rubber from older trees is not appreciably better than from young trees. The slope or type of the stress strain curve is generally the same, although sometimes somewhat better for old trees. The rate of cure diminishes in an appreciable degree with the age of the tree and the viscosity for old trees is nearly always better.

The preservative treatment of poles, B. L. GRONDAL (*Univ. Wash. Forest Club Ann.*, 5 (1917), pp. 8-11, fig. 1).—In this paper the author discusses modern methods of treating poles, including the recently developed perforation process in which the poles are pierced in a number of places to insure greater penetration of creosote just above and just below the ground line where fungi are most active.

Mapping methods, C. M. CADE (*Forestry Ann. [Mich. Agr. Col.]*, 2 (1917), pp. 19-24, fig. 1).—A discussion of present practice in mapping land areas, including forest tracts.

DISEASES OF PLANTS.

Report of the associate plant pathologist, C. D. SHERRAKOFF (*Florida Sta. Rpt.* 1916, pp. 80-98, figs. 5).—The line of investigations reported upon is similar to that previously noted (*E. S. R.*, 35, p. 844), including studies of diseases of vegetables and a disease of pineapples.

Chief attention has been paid to damping-off of seedlings, *Rhizoctonia* sp. being the most troublesome fungus in Florida in this respect. Experiments in the control of damping-off have been carried on, and the application of 0.5 per cent copper sulphate solution has given good results with lettuce, the seeds germinating normally and no damping-off following. For seed disinfection, formalin and corrosive sublimate have been compared, the author having found in the use of corrosive sublimate with a number of kinds of seeds, particularly

celery, that the temperature of the solution bears an important relation to the amount of injury produced.

A brief description is given of a rot of tomato fruit due to an undetermined species of *Phytophthora*. This disease, which is called buckeye rot, is to be the subject of a special publication. Brief notes are given on bacterial diseases of celery, lettuce, peppers, tomato, and potato, and on fungus diseases of a number of other vegetables.

In connection with the pineapple wilt studied by the author, in which study field observations and laboratory experiments were carried on, nematodes were found in almost every instance to be the cause of some of the injury. In addition to nematodes, *Thielaviopsis paradoxa* was found to attack the roots and stems of pineapples, causing considerable loss.

Report of the laboratory assistant in plant pathology, J. MARZ (*Florida Sta. Rpt. 1916*, pp. 99-112, figs. 7).—The author reports upon his investigations on pecan dieback and the leaf blight of the fig.

The investigations of the dieback are in continuation of those previously described (E. S. R., 35, p. 849). Experiments in controlling the organism, *Bortryospheria berengeriana*, have been continued, and pruning dead wood from the trees has been found satisfactory in keeping down the disease. Spraying with lime-sulphur solution did not seem to have any effect.

The leaf blight of fig is described as characterized by a yellowish, water-soaked appearance on both surfaces of the leaves. The twigs and fruit may be infected by the spreading mycelium, although the blight is primarily one of the leaves. An organism has been isolated which experiments have shown to be the cause of the trouble and which has been determined as *Rhizoctonia microsclerotia* n. sp.

[Plant diseases in New Jersey, 1915], M. T. COOK (*Ann. Rpt. N. J. Bd. Agr., 43 (1916)*, pp. 48-54).—Besides notes on plant diseases, 214 of which were observed during 1915, and mention of the four epidemics of economic diseases occurring in New Jersey during the year, namely, fire blight of pear and apple, anthracnose of bean, mosaic of tomato, and *Rhizoctonia* of potato, the author reports more specifically on potato diseases, including scab, leaf roll, blackleg, discolorations (*Fusarium oxysporum* and *F. radicola*), and powdery scab (*Spongospora subterranea*), also on some preliminary experiments regarding the control of the diseases, the results of which varied considerably. The administrative report for 1915 of the State plant pathologist is included.

[Fungus pests and their control] (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. St. Vincent, 1915-16*, pp. 24-30).—The information here given relates to both insect enemies (particularly thrips on cacao) and fungus diseases of plants, with a discussion of conditions and remedial measures. Specimens were examined of arrowroot rhizomes affected with the so-called burning disease, which appears to be due to *Rosellinia bunodes*. Internal boll disease of cotton is thought to be related to the presence of cotton stainers.

Some parasitic fungi of Japan, T. HEMMI (*Bot. Mag. [Tokyo], 30 (1916)*, No. 353, pp. 334-344, figs. 5).—A discussion is given of *Clasterosporium degenerana* on *Prunus mume*, *Septoria perila* on *Perilla ocimoides*, and *Armatella litsea* on *Litsea glauca*, and a discussion with technical descriptions of the new species *Septoglauum nissimae* on *Quercus dentata* and *Septoria petastidis* on *Petasites japonica*.

Combating nematodes by the use of calcium cyanamid, J. R. WATSON (*Florida Sta. Rpt. 1916*, pp. 55-63).—In addition to a previous account (E. S. R., 37, p. 453), the author describes experiments in the use of calcium cyanamid for the control of nematodes, particularly with tomatoes, peach trees, and pineapples.

Tomato plants were so badly burned as to be practically worthless when placed in the soil nine days after the application of the cyanamid. A second crop planted after an interval of about four months gave a fair crop of tomatoes, while plants in check plots yielded nothing. Nematodes were found in all the plots. Experiments in which cyanamid was applied at the rate of 1,500 lbs. per acre on light soil, and in which tomato plants were set out at once, showed that while the plants were severely burned, they recovered, made good growth, and were nearly free from nematodes. These experiments seem to indicate a correlation between the character of the soil and the amount of cyanamid used.

Where cyanamid was applied to peach trees at the rate of 1 to 6 lbs. per tree, it was found to reduce the number of nematodes present, although not penetrating the soil readily.

With pineapples, it was found that cyanamid could be applied at the rate of 1,500 lbs. per acre without injuring the plants, the nematodes being fewer than on untreated plants and the pineapples having a better color, probably due to the nitrogen of the fertilizer.

A new disease of wheat, E. F. SMITH (*U. S. Dept. Agr., Jour. Agr. Research*, 19 (1917), No. 1, pp. 51-54, pls. 5).—The author reports the occurrence of a disease of wheat that has appeared in Indiana, Arkansas, Kansas, Missouri, Oklahoma, and Texas, and is believed to be present in other States. Numerous bacteria have been found associated with this disease, and while not definitely claiming that it is a bacterial disease, the author believes it to be of bacterial origin. A description is given of infected parts of plants, and attention is called to the disease in the hope that material may be forwarded to the author for further study.

Observations on stalk disease of wheat, J. CAPUS (*Bul. Soc. Path. Veg. France*, 2 (1915), No. 2, pp. 94-104).—Giving the results of observation and experimentation on *Leptosphaeria herpotrichoides*, as causally connected with the appearance of foot or stalk disease in wheat, the author states that the trouble is favored by the susceptibility of some varieties, by soil and atmospheric humidity and warmth (during winter and early spring), by close seeding, by the presence of weeds, and probably by continued seeding of the same land to wheat.

Sulphuric acid in dilute solution, when used in early spring, kills the lower leaves and sheaths, admitting air and sunshine, both of which are unfavorable to the development of the foot or stalk disease fungi. This treatment is helpful if used during latency or imminence of the disease, but not markedly so after the attacks are well developed.

Common diseases of cucumbers and melons, W. H. MARTIN (*New Jersey Stas. Circ.* 68 (1917), pp. 11, figs. 5).—Popular descriptions are given of a number of the more common fungus and bacterial diseases to which cucurbitaceous plants are subject, together with suggestions for their control so far as definite means are known.

A form of potato disease produced by *Rhizoctonia*, G. B. RAMSEY (*U. S. Dept. Agr., Jour. Agr. Research*, 9 (1917), No. 12, pp. 421-426, pls. 4).—In this contribution from the Maine Experiment Station the author gives a description of a type of potato tuber disease observed for the first time in southern Maine a few years ago. No positive evidence has been found of the trouble in northern Maine nor any reference to this form of injury elsewhere in the country.

Two phases of injury are produced by the fungus, one whose external appearance somewhat resembles scab and which extends as a dry core into the tuber, another in which the shrinkage of tissues has formed a pit or canal in the center of the infected area, frequently suggesting wireworm injury. Dis-

tological studies in all stages of the progress of the disease show the presence of *Rhizoctonia*, and pure cultures of the fungus have been repeatedly obtained from the interior of the diseased areas. Evidence is presented that indicates that the host cells die and lose their contents and the walls suberize and are more or less broken down in advance of the fungus filaments. This, the author states, might lead to the supposition that part of the action is due to a toxin secreted by the fungus. Cell wall penetration by the hyphae is thought to occur, but this is believed to be the exception rather than the rule.

A new strain of *Rhizoctonia solani* on the potato, J. ROSENBAUM and M. SHARPOVALOV (*U. S. Dept. Agr., Jour. Agr. Research*, 9 (1917), No. 12, pp. 413-420, pls. 2, figs. 3).—A description is given of a strain of *R. solani* which was isolated from the stems of potatoes in Maine during the summer of 1916. This strain is distinguished from the more common form of *R. solani* by the more pronounced lesions produced when inoculated on injured stems or tubers; by the reaction, growth, and character of sclerotia on definite media; and, morphologically, by measurements of the mycelium, also of the short sclerotial cells, and by the measurement of the diameter of germ tubes when the short, or barrel-shaped, cells enveloping the sclerotia are placed in drops of water to germinate.

An investigation of the potato rot occurring in Ontario during 1915, D. H. JONES (*Abstr. Bact.*, 1 (1917), No. 1, pp. 57, 58).—Reporting briefly the result of studies made during 1915 and 1916, the author states that potato diseases are greatly favored by such continued wet weather as prevailed during 1915. *Rhizoctonia* was the principal and soft rot bacillus the secondary cause of the black basal stem rot and collapse which occurred in many places during 1915, the organism producing only a slightly shrunken, brown canker where the cortical tissue alone was punctured. The soft rot bacillus could not penetrate healthy, unbroken epidermal tissue, but when introduced beneath the punctured epidermis of a young potato stem or tuber, or of carrot, turnip, or cauliflower, it produced a characteristic soft rot. Seed tubers showing sclerotia of *Rhizoctonia* (black scab) are most likely to give a diseased crop unless disinfected, which may be done by soaking them in water for two or three hours and then in 0.1 per cent corrosive sublimate for five or six hours.

Fusarium sp. caused much of the tuber rot observed at harvesting time and in storage. The disease may be carried over in debris of the potato crop left in the soil, high humidity favoring its development.

Diseases of tomatoes, M. T. COOK and W. H. MARTIN (*New Jersey Stat. Circ.* 71 (1917), pp. 8, figs. 6).—The authors briefly describe the more prevalent fungus, bacterial, and other diseases of tomatoes, and offer suggestions for their control.

Apple blotch and its control, J. W. ROBERTS (*U. S. Dept. Agr. Bul.* 534 (1917), pp. 11, pls. 2, figs. 3).—The author describes the blotch of fruit, foliage, and twigs of the apple due to the fungus *Phyllosticta solitaria*, and gives the results of his investigations on the disease and on methods of control. His cross-inoculation experiments are said to confirm the inoculation work of Scott and Rorer (*E. S. R.*, 20, p. 1044).

As an explanation for the few infections which occur late in the season, the author suggests an increased resistance of the host as well as a gradual decrease in the number of spores produced by the fungus. A large number of mummied fruits were examined throughout the spring but no spores were found, and hence the author concludes that mummies are not an important source of infection.

It is claimed that apple blotch may be controlled by three sprayings with 3:4:50 Bordeaux mixture applied at intervals of three weeks, the first spray

being applied about three weeks after the petals have fallen. Summer-strength lime-sulphur solution may be substituted for Bordeaux mixture where the disease is not severe, thus lessening the risk of injury.

Apple scab control in British Columbia, R. M. WINSLOW (*Canad. Hort.*, 99 (1917), No. 2, pp. 52, 56-58, fig. 1).—The rapid spread of apple scab in British Columbia during the last three years is said to have caused much alarm, discouraging some very careful growers. In view of the losses of 1915, an extensive series of tests was carried out in 1916 with lime-sulphur, which was applied when the leaves were from $\frac{1}{4}$ to $\frac{1}{2}$ in. in length, when the blooms were just about to open, when the blooms were falling, and again 14 days later, the last three of these sprays proving to be of the greatest general utility. A wet July makes a summer spray advisable, in addition to those above mentioned. An abnormally bad year for scab may be followed by one almost free therefrom. The sprays increased the percentages of absolutely clean and marketable fruit, the average weight of the fruit, the total yield, the set of fruit, and the vigor of the foliage. Tests with Bordeaux mixture and with atomic sulphur gave less favorable results than those with lime-sulphur, which gave fair control of scab even when unsprayed trees showed from 98 to 100 per cent infection.

The biology of *Exoascus deformans*, A. MANARESÌ (*Riv. Patol. Veg.*, 7 (1915), No. 7, pp. 193-201).—The author during 1912 to 1915 made a study of several varieties of peach in the Province of Bologna as affected by *E. deformans*, the cause of leaf curl, in connection with the weather during that period and the treatments employed. The results are tabulated and discussed. Strong Burgundy mixture applied about the middle of March gave good results, later applications being ineffective.

Comparative resistance of *Prunus* to crown gall, C. O. SMITH (*Amer. Nat.*, 51 (1917), No. 601, pp. 47-60, figs. 6).—This is a more detailed account of the work already noted (*E. S. R.*, 36, p. 352).

Winter injury of grapes, F. E. GLADWIN (*New York State Sta. Bul.* 433 (1917), pp. 107-139, pls. 8).—As a result of a study of light crops of grapes during the years 1909 to 1916, the author was led to the conclusion that such crops are due to injury to immature shoots by low temperatures. Embryo flower clusters were found to be injured by low temperatures if they entered the dormant period immature, yet the foliage of the bud might expand normally. The effect of low temperatures following various periods when temperatures rose high enough and continued for sufficient time to start activity is discussed.

Experiments testing the effect of various fertilizer elements on maturity indicate that neither nitrogen, phosphoric acid, nor potash influenced maturity, and hence their effect was not apparent as influencing the degree of killing. The extent of injury was observed to be closely correlated with poor drainage of soils, although some killing occurred where drainage was reported as satisfactory. Severe pruning after late frost injury in the spring is believed to favor bud killing indirectly through inducing rank wood growth. Maturity of bud and wood is probably correlated with the ripeness of the fruit, as determined from sugar analyses of the fresh juice.

Resistance to low temperature is considered a species character and is possibly correlated with hardness of wood.

Why and when winter kills grapes, F. H. HALL (*New York State Sta. Bul.* 433, popular ed. (1917), pp. 3-8, figs. 4).—A popular edition of the above.

A fatal disease of mulberry, L. MONTEMARTINI (*Riv. Patol. Veg.*, 7 (1915), No. 8-9, pp. 238-242).—The results to date of the inquiry regarding a disease of mulberry (*E. S. R.*, 33, p. 448) in seven Provinces have already shown it to be

widely diffused and of considerable importance, but not so severe on clayey and limy soils as on some others indicated.

Anthraxnose of Japanese persimmon, L. MAFFEI (*Riv. Patol. Veg.*, 7 (1915), No. 6, pp. 161-163).—A brief description is given of a disease of fruits of Japanese persimmon in the botanical garden at Pavia, caused by *Glauosporium kaki*.

Report of the plant physiologist, B. F. FLOYD (*Florida Sta. Rpt.* 1916, pp. 50-59, figs. 6).—This report gives the results of a study of the toxic effect of certain organic chemicals on citrus and of injury to citrus trees by ground limestone.

Previous investigations (E. S. R., 29, p. 248) having shown that dieback of citrus trees could be induced by organic nitrogenous fertilizers, the author reports on experiments to test the action of vanillin on both citrus seedlings and citrus cuttings. This organic compound was added to nutrient solutions used at various rates in the growth of seedlings, and, while marked injury to the roots was produced, no gum, which is characteristic of the disease dieback, was formed in grapefruit seedlings. With citrus cuttings vanillin produced no gum, but, as no gum was formed in a series of experiments in which copper sulphate was used, it is believed that the lack of gum formation in cuttings may have been due to the absence of growth.

The attention of the station having been called to apparent injury in a number of groves where ground limestone had been applied, an investigation was made. Pot experiments indicated that ground limestone can, under limited conditions, induce injury to citrus trees, and that this injury shows itself by a freching, or chlorosis, of the foliage of the trees.

Some cases of injury to citrus trees apparently induced by ground limestone, B. F. FLOYD (*Florida Sta. Bul.* 137 (1917), pp. 161-179, figs. 6).—This bulletin is essentially a reprint from the article noted above, with suggestions for the control of the injury.

Report of the plant pathologist, H. E. STEVENS (*Florida Sta. Rpt.* 1916, pp. 66-79, figs. 2).—The investigations reported by the author have been continued along about the same lines as previously.

A number of citrus trees which had been treated for gummosis have been kept under observation for three years (E. S. R., 33, p. 55), and many of the active areas have healed following the treatment. A study is being made of the fungus and bacterial flora associated with gummosis and several organisms are under observation, among them *Phomopsis citri* and *Diplodia natalensis*, to determine whether these fungi are active agents in producing the disease.

Pruning experiments for the control of melanose have been continued with some success, summer pruning giving very good results in reducing the amount of injury.

The author is continuing his investigations on citrus canker, paying particular attention to laboratory studies of the organism, especially in relation to soils. *Pseudomonas citri* has been cultured in sterilized soil for more than a year, and experiments have demonstrated that it grows readily on sterilized soil under moist conditions. Soil cultures made in the spring of 1915 have been kept under observation and in nearly every instance the organism has been found present. The infected soil has been applied to healthy citrus foliage and in all cases canker infections have resulted. Tests have been made of field soil collected under infected trees, and while in a majority of the tests there were negative results, in a few instances the presence of the organism was established by inoculation experiments.

Brief descriptions are given of lightning injury to citrus trees, the lemon brown rot fungus, citrus scab, withertip, and stem end rot. In connection with

he investigation of the lemon brown rot fungus, the author reports having isolated from gumming citrus trees an organism which, when inoculated upon healthy lemons, developed a brown rot similar to that produced by *Pythiactypha strophthora*.

The origin and cause of citrus canker in South Africa, ETHEL M. DODGE (Union No. Africa Dept. Agr., Sci. Bul. 8 (1916), pp. 20, pls. 10, figs. 3; ditto, Div. of Agr. [Pub.] 20 (1916), pp. 8, pls. 6).—Citrus canker, claimed by Hasse (E. S. R., 33, p. 149) to be caused by an organism described by her as *Pseudomonas citri*, but designated by the present author as *Bacterium citri*, is said to have been imported on grapefruit trees from Florida. A brief history of the disease in Africa and elsewhere is given, with an account of study by the author.

At first the trouble was taken to be a severe outbreak of scab (*Cladosporium citri*). Serious effects may be produced even in the nursery. The organism attacks in buds, leaves, fruits, and branches. Orange, lime, and related plants are attacked. It is claimed that under the dry conditions of the Transvaal the disease has been effectively controlled with a 4:4:50 Bordeaux spray. This should be used two or three times the first year with a single spraying every year or two thereafter. Badly infected stock should be burnt and old cankers should be searched for, as infection may occur after four years of apparent freedom from canker.

Anaberoa, M. K. VENKATA RAO (Mysore Agr. Calendar, 1917, pp. 26, 27, 30, fig. 1).—Anaberoa of the areca palm in parts of Mysore is described in connection with the fungus locally known as "annbe," which attacks trees, usually over 10 years of age, at the roots and collar and apparently spreads through the soil and by air-borne spores. Other plants of different genera, and even different orders, are also attacked by the fungus, which causes the same general symptoms, ending in the death of the tree. No remedial measures are effective after the tree is attacked.

Diseases and pests of the mango, K. KUNHIKANNAN and C. NORONHA (Mysore Agr. Calendar, 1917, pp. 7, 10, 11, figs. 3).—Failure of mango trees in Mysore to set fruits has been shown by recent observations to be due to a fungus which attacks young leaves and flower spikes. It develops most rapidly under moist conditions, the drying up of the flowers following a succession of misty or damp nights. This fungus is distinguished from other local mildews which attack tobacco and roses. Bordeaux mixture applied to the young leaves and flower spikes just before the blooms open controls the disease. A combined treatment is being sought for both fungi and troublesome insects, some of which are mentioned in this article.

Powdery mildew of dwarf magnolias, M. TURCONI (Riv. Patol. Veg., 7 (1915), No. 6, pp. 164-167).—The disease produced by species of *Erysiphe* on several plants is said to be associated in the case of *Magnolia pumila* with a fungus, the characters of which, as described, are considered to agree with those of *E. polygoni*.

Black canker of chestnut, B. PEYRONEL (Atti R. Accad. Lincei, Rend. Cl. Sci. Fis. Mat. e Nat., 5. ser., 25 (1916), II, No. 11, pp. 459-461).—This is a preliminary discussion of a study of black canker of chestnut, now becoming important in Italy, its manifestations, the causal or contributing agents (such as atmospheric conditions), and various related problems, such as the mode of penetration by the fungi, no trace of which appears outwardly in the early stages of the disease.

Black canker of chestnut, L. PERI (Atti R. Accad. Lincei, Rend. Cl. Sci. Fis. Mat. e Nat., 5. ser., 25 (1916), II, No. 5, pp. 172-176, figs. 2).—Previous reports on black canker of chestnut (E. S. R., 33, p. 854; 35, p. 250) are continued.

The author states that whether near the basal portions of the larger roots or at the collar and above that region, necrosis of the cortical tissue is a phenomenon secondary to the death of the cambium. The former portion showed at first no microorganisms, but these could be demonstrated by means of the microscope and sometimes by means of culture methods in the cambium, sapwood, and heartwood. It appears that the rapidly progressing primary infection is independent of the deeper fungi, which are probably secondary. The infection, which proceeds up the trunk, appears to have its origin at the collar.

The primary infection in black canker of chestnut, L. PETRI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5. ser., 25 (1916), II, No. 12, pp. 499-501, figs. 2).—More recent study by improved methods confirms the observations above noted regarding the phases or stages of black canker of chestnut. The attack originates near the junction of the roots and trunk. The identity of the primarily causal fungus remains unknown.

Leaf cast in horse chestnut, L. MONTMARTINI (*Riv. Patol. Veg.*, 7 (1915), No. 8-9, pp. 243-248).—This is a discussion of the factors involved in the early shedding of leaves by horse chestnut, including foliar surface and branching as related to transpiration surface and conduction. The author states that the number of conducting elements is the same as that of actively transpiring elements, both increasing in number with the amount of branching.

A needle blight of Douglas fir, J. R. WEIR (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 2, pp. 99-104, pl. 1, figs. 3).—A description is given of a serious disease of Douglas fir which is causing damage to young trees and seedlings in the Northwest both in the nursery and the forest. A study of the disease indicates that it is due to a fungus, the systematic position of which has not been definitely determined.

Some preliminary experiments in spraying with a solution of soap and Bordeaux mixture give indications that this will prove a successful means of controlling the fungus.

[White pine blister rust in Canada], H. T. GÜSSOW (*Canad. Forestry Jour.*, 13 (1917), No. 1, pp. 900-906, figs. 6).—In this article, which has been issued also in pamphlet form, a brief popular account is given of the importation of the American 5-leaved pine (*Pinus strobus*) into Europe, its attack there by the blister rust fungus, the importation of the latter into America on seedlings, and the spread of the disease to such an extent that this pine and all the interests connected with it are seriously threatened. A plea is made for concerted action looking to the control of this disease. Eradication of all currant and gooseberry plants in the neighborhood of the pines is the remedy which is offered with most confidence.

White pine blister rust on currants, W. A. MCCUBBIN (*Canad. Hort.*, 40 (1917), No. 2, p. 34, fig. 1).—Certain features observed in the Ontario outbreak of white pine blister rust suggest that the fungus may overwinter on currant bushes. Besides the large area on the Niagara Peninsula previously known to be infected, the disease occurred, so far as known, only in small isolated patches in Ontario in localities which are named. The disease has also been reported from Quebec. The appearance and behavior of the disease on both white pine and currant are briefly described.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A check list of mammals of the North American continent, the West Indies, and the neighboring seas, D. G. ELLIOT (*Publ. Field Columb. Mus. [Chicago]*, Zool. Ser., 6 (1905), pp. V+761, pl. 1; Sup., New York: Amer. Mus. Nat. Hist., 1917, pp. IV+192).—The check list proper is supposed to include all

the species and races of mammals, described up to the date of publication, which inhabit the North American continent from the Arctic Ocean to the Province of Cauca in Colombia, South America, together with those of the West India Islands and the adjoining seas. They are arranged systematically according to the author's views, and descriptions are given of those forms that have received names since his two previous works were published¹ (E. S. R., 26, p. 233). The species enumerated in the list number 1,309 and 676 races of species found within the geographical limits embraced, together with 22 races of exotic species originating in South America. The type locality and geographical distribution, where known, are given in every instance.

The supplement, which is edited by J. A. Allen, lists the species and subspecies that have for the most part been described since the publication of the earlier works on which the check list was based, down to the end of the year 1914. In addition to being a supplement to the check list, it is also a continuation of the preceding two manuals on the subject, since it gives descriptions of forms added as well as the usual check list matter. It contains many changes in generic nomenclature from that of the check list proper, many groups treated in the latter as subgenera being given the rank of genera, while the changes in generic names shown to be necessary since the publication of the check list are duly recorded.

Report of the entomologist, J. R. WATSON (*Florida Sta. Rpt. 1916, pp. 51-55*).—Attempts to establish *Calosoma sycophanta* were not successful and it appears that this beetle is not adapted to the climatic conditions of Florida.

In further observations (E. S. R., 35, p. 852) of the Florida flower thrips ([*Euthrips*] *Frankliniella tritici projectus*) kept in test tubes constantly supplied with fresh rose petals, many lived for several weeks, and one individual lived for 59 days. The observations establish the fact that they spend the winter as adults, though there may be some breeding during the warm periods in any month of the year, but there are no indications that they ever enter the ground or seek other shelter than the depths of the flowers. The author's observations show that prolonged and dashing rain is the chief natural factor in reducing the numbers of thrips. Spraying work in the control of thrips on citrus indicates that it will pay well for one spraying even when the bloom is unusually irregular and scattering.

Studies made of an outbreak of thrips on strawberries at Waldo showed the infestation to be heavy, as many as 50 adults and larvæ being found in a single bloom. When thus heavily infested the bloom failed to set fruit. Successful control of the pest was obtained through the application of a home-made tobacco decoction of tobacco stems soaked overnight in enough water to cover them, applied at the rate of 3 gal., and a pound of soap to each 15 gal. of water.

In April, 1916, the Florida flower thrips was found to injure camphor trees, the damage to the unfolding buds of camphor being very similar to that caused by the camphor thrips, previously noted (E. S. R., 31, p. 751).

Work on combating nematodes by the use of calcium cyanamid is noted on page 652.

The report concludes with brief notes on the insects of the year, including accounts of an unusual outbreak of the striped cucumber beetle in south Florida, where they killed bearing okra plants and watermelons and even attacked Irish potatoes, and destroyed the young growth of citrus, it being the first record of injuries to citrus in Florida by this pest. The woolly white fly (*Aleurothrixus howardi*) continued to extend slowly into the regions adjacent to its previous range. The cowpea pod weevil (*Chalcodermus acneus*) is said to have

¹ Synopsis of North American Mammals. (Field Columbian Mus., Zool. Ser., 2 (1891).

been more abundant than usual during the spring of 1916, it being especially so on the California black-eyed variety of cowpeas. A June bug (*Anomala marginata*) was especially abundant in June. The twig girdler (*Oncideres ringulatus*) was the cause of several complaints from the lower east coast where it attacked "Australian pines."

Undesirable insect immigration into New Jersey, H. B. Weiss (*Canad. Ent. 49 (1917), No. 9, pp. 295-298, pl. 1*).—The author calls attention to the fact that fully one-half of the principal injurious hexapods in the United States have been introduced from foreign countries and that the injuries inflicted by them have been enormous. Mention is made of the introduction into New Jersey of the mole cricket *Gryllotalpa gryllotalpa* from Holland (E. S. R., 34, p. 653), the large cockroach *Blaberus discoidalis* from South America (E. S. R., 37, p. 255), *Strophantius pyrioides* from Japan, and *Cholus forbesii* from Colombia.

Fumigation of greenhouses, E. N. Cory (*Maryland Sta. Bul. 205 (1917), pp. 265-284*).—This bulletin is based upon fumigation experiments conducted with the view of ascertaining the effect of certain doses of hydrocyanic-acid gas on insects and plants when certain factors are known, including moisture and temperature, meteorological conditions, time (day or night), and length of exposure. The investigations were largely limited to the determination of effective dosage for certain insects under normal conditions, but little work having been done with one factor constant and others variable in order to ascertain the effect of the variables, which, it is pointed out, is a very important phase of fumigation.

The conclusions drawn from the work carried on are as follows: "Fumigation in the presence of daylight is likely to result in injury to the plants if a sufficient dose is used to control the ordinary insects. . . . Overnight fumigation is recommended because (1) fumigation in late afternoon for a short period is impractical in winter, since ventilation after nightfall is likely to result in chilled or frozen plants; (2) long exposure at night does not give as much injury as a short exposure during the day.

"Definite doses under optimum conditions of moisture and temperature for different horticultural varieties of plants can be recommended. Definite doses, under the normal greenhouse conditions, that will kill certain species of insects are recommended. Slight reductions in the doses may be effected by increasing the temperature up to a maximum of 70° F. without danger of injury to the plants if the moisture is kept at or below 50 per cent saturation. High moisture is decidedly an important factor as far as injury to the plant is concerned. High moisture will increase the mortality if the dose is below the optimum for the insect involved.

"High temperature will increase the mortality if the dose is below the optimum for the insect involved. Plants that are normally grown under warm conditions, such as 'stove plants,' will not be injured by fumigations in a temperature that would injure bedding plants and plants grown for cut flowers. Plants other than 'stove plants' should be fumigated if possible with the optimum dose for the insect involved, at a night temperature at or below 50° and with the atmosphere about half saturated."

In an appended table the author gives the maximum safe dose for various plants under normal greenhouse conditions.

A neglected factor in the use of nicotine sulphate as a spray, W. Moore and S. A. Graham (*U. S. Dept. Agr., Jour. Agr. Research, 10 (1917), No. 1, pp. 47-501*).—Illness caused by the consumption of greenhouse lettuce that had been sprayed with nicotine sulphate led to the studies at the Minnesota Experiment Station here reported.

The results show that nicotin sulphate is nonvolatile, but that alkalies contained in hard water and soap set free the nicotin contained in nicotin sulphate sprays. Thus, in order to obtain the maximum efficiency of tobacco extracts containing nicotin sulphates, they should be rendered alkaline before using. This is thought to explain the different results obtained in the use of tobacco extracts, and also why soap greatly increases the efficiency of sprays containing nicotin sulphate. The fact that nicotin sulphate is nonvolatile also explains the cases of poisoning from eating lettuce sprayed with tobacco extracts containing this material.

"Commercial tobacco extracts containing nicotin sulphate should not be used in the greenhouse, at least not on plants which are later to be used for food. Tobacco extracts or tobacco papers containing free nicotin may safely be used in the greenhouse on plants such as lettuce without endangering the lives of the consumers. Food plants such as lettuce sprayed with tobacco extracts containing free nicotin should not be cut for the market until the day after spraying. If the temperature of the house is low, a longer period should be given the nicotin to evaporate from the leaves."

Grasshopper control, C. R. JONES (*Colorado Sta. Bul.* 253 (1917), pp. 3-29, figs. 17).—A summary of information on the general life history, habits, and practical methods of control of grasshoppers, based upon work in Colorado during the outbreaks of 1916. The subject is taken up under the headings of life history; food habits—the plants affected; natural and artificial control; apparatus for capturing grasshoppers. Including the hopperdozer, balloon catcher, and the live hopper machine; insecticides; diseases; etc. The bulletin concludes with a discussion of the work during 1916.

A further contribution to the study of *Eriosoma pyricola*, the woolly pear aphid, A. C. BAKER and W. M. DAVIDSON (*U. S. Dept. Agr., Jour. Agr. Research*, 19 (1917), No. 2, pp. 65-74, pls. 2, fig. 1).—In the present paper, which gives the complete life of cycle of *E. pyricola*, the authors first discuss the history of the different species of plant lice recorded on pear roots (*Pyrus communis*) at some length. The species *Prociphilus pyri* (Fitch) has been found to be a homonym and the name *P. fitchii* is proposed for it. It is shown to be definitely established that the European pear-root aphid (*E. pyri* Goethe), described in 1884, is the alternate form of the elm species *E. lanuginosa* (Hartig) of 1841.

In a paper previously noted (*E. S. R.*, 35, p. 403) the authors described the American woolly pear aphid, previously thought to be the woolly apple aphid, under the name *E. pyricola* and called attention to its close resemblance in general structure to European specimens of *E. lanuginosa*. Studies since conducted have shown that the marked difference in the wax pores and minor differences in the sensoria then considered as representing a very distinct species are not the same in the spring forms living on elms as in the summer and fall forms living on pear roots, those in the spring forms being very similar to those of *E. lanuginosa*. The very great similarity between the spring forms of *E. pyricola* and *E. lanuginosa* has led the authors to believe that the same variation will be found between the spring and fall forms of *E. lanuginosa*, which if it proves true—and it is regarded as all but proved—will result in *E. pyricola* becoming a synonym of *E. lanuginosa*.

Thus it would appear that "the destructive woolly pear aphid of this country is a European insect imported into the Western States on pear stock. It has spread rapidly in the West in the last 25 years and now occurs from Washington to California, although as yet it is most destructively abundant in California. The isolated infestations in the Middle West and in the East are due to separate infested importations. While the alternate winter forms thrive best on European elms, the species is able to live successfully upon the common American

elm and at no very distant date may become entirely adapted to this native tree. The species is liable through importations to gain a foothold in any pear-growing region, for, as recently as 1916, skins have been collected on seedling nursery stock. . . .

"The fall sexuparous migrants leave the pear roots upon which they have developed and fly to elm trees to deposit the sexes on the trunks and limbs. These migrants settle on *Ulmus americana* and *U. campestris*. The latter tree is distinctly preferred; in fact, no perfect galls have been produced on the former. The sexed female after mating deposits a single egg in a crack in the bark or underneath a bud scale. . . . From this egg hatches the young stem mother which ascends a trunk or limb and seeks an expanding leaf. In 1916 hatching commenced March 23 and extended until April 18, the majority hatching during the first two weeks of April."

The newly-hatched stem mother settles on the underside of the elm leaf near the midrib, generally not far from the base. "After the young aphid has fed for a very few days, the leaf begins to curl around it, and the curling and twisting become more pronounced as the insect grows, so that by the time it has reached the third instar the leaf in the form of a gall has completely closed around it." Following upon the maturing of the stem mother the galls grow very rapidly and change their shape. "The possibility of the second generation's wingless forms leaving the parent gall and founding new galls should not be overlooked; yet the observations made indicate either that no such movement exists or that it is uncommon."

In 1916 nearly every gall examined contained winged forms by the fourth week in June, large numbers of the earlier galls had been vacated by July 10, and by the end of July hardly a gall with living inmates could be found. Spring migrants were observed resting on pear foliage and actively crawling up and down the lower part of the pear trunks, young deposited by them were taken in spider webs at the base of pear trees, and it appears that the young are normally deposited on pear trunks at or near to the soil surface. Spring migrants when placed in Petri dishes with pieces of pear roots on wet sand deposited young which readily settled and fed upon the roots and which precisely resembled in structure the newly-born larvæ of the pear-root aphids. The young deposited by the spring migrants readily fed on pear stocks of Kieffer, French, and Japanese varieties, but like the root-dwelling larvæ absolutely refused to feed upon apple roots and fed only in very rare instances upon roots of the quince.

The life history account is accompanied by a diagram of the complete life cycle of the species. A list of ten titles cited is appended.

The aphid of tea, coffee, and cacao (*Toxoptera coffeæ*), F. V. THEOBALD (*Bul. Ent. Research*, 7 (1917), No. 4, pp. 337-342, figs. 5).—A summarized account of *T. coffeæ*.

Observations on *Lecanium corni* Bouche and *Physokermes piceæ* Schr.. F. A. FENTON (*Canad. Ent.*, 49 (1917), No. 9, pp. 309-320, pl. 1, figs. 15).—A report of biological studies of the European fruit lecanium (*L. corni*) and the spruce scale (*P. piceæ*) at Madison, Wis.

L. corni, observations of which in New York by Slingerland (E. S. R., 6, p. 1004) and by Lowe (E. S. R., 9, p. 71) have been noted, now occurs throughout most of the United States. It has a wide variety of host plants, a list here given including 36 genera, representing 21 families. In spite of the wide range of its host plants and its general distribution this insect seldom becomes of economic importance, although serious outbreaks of it have been recorded, it having occurred in New York in destructive abundance on the plum and in

California on apricots and prunes. Successful transference to different host plants is recorded.

Several parasites have been reared in Michigan from *L. corni*, which on some trees was so badly parasitized as to be almost exterminated. In the vicinity of Madison, Wis., *Coccophagus lecanii* was by far the most numerous and effective, though in California *Comys fusca* appears to be the chief check. Several insect predators are mentioned and the adult females are said to be susceptible to several fungus diseases, of which that caused by *Cordyceps clavulatum* is the most important.

The spruce scale, a European pest first discovered in this country at Hartford, Conn., in 1906, and since found in various northern localities as far west as Wisconsin has become a serious pest. It appears to be dependent upon spruce and pine for host plants, preferring the Norway spruce (*Picea abies*). A parasite representing a new species, described by Girault as *Holcencyrtus physokermis* (E. S. R., 36, p. 555), which appears to have been introduced with *P. picæ* from Europe, is effective in checking its spread. *Chalcidoneurus albicornis* and several encyrtids were also reared from this scale.

Pupæ of some Maine species of Notodontidae, EDNA MOSHER (*Maine Sta. Bul.* 259 (1917), pp. 29-84, figs. 5).—The importance of being able to recognize insect pests in any stage of their life cycle led to studies of the pupæ of some of the more common forms of notodontid moths found in Maine, a report of which is here presented. Twenty-eight species representing 21 genera are thus dealt with.

Life history of *Plutella maculipennis*, the diamond-back moth, H. O. MOSHER (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 1, pp. 1-10, pls. 2).—This report, based largely upon studies made since 1908 at Rocky Ford, Colo., includes observations at Phoenix, Ariz.

P. maculipennis is a cosmopolitan species which in the United States apparently occurs wherever cabbage is grown. It feeds exclusively on cruciferous plants, having been observed by the author to feed upon cabbage, cauliflower, turnip, radish, rape, kale, mustard, Chinese mustard, kohlrabi, water cress, horse-radish, sweet alyssum, and candytuft, and also on two weeds, wild watercress (*Roripa sinuata*) and hedge mustard (*Sisymbrium* sp.). While cabbage is decidedly the favorite, rape, cauliflower, turnip, and mustard are readily eaten.

Seven generations occur annually at Rocky Ford, where the winter is passed as an adult. The egg stage covered from 3 to 6 days, the larva stage from 9 to 23 days, and the pupa stage from 5 to 13 days. In the South the diamond-back moth is active throughout the year, and the larvæ are to be found at all seasons. The larvæ reared at Rocky Ford during May lived as leaf miners for the first two or three days of their existence, whereas those reared at Phoenix during February lived in mines for four days.

While potentially a serious pest, it is normally held in suppression by parasites, of which the most effective is an ichneumonid, *Angitia plutellæ*, which in turn is occasionally parasitized by *Spilochaetis delira*. From 50 to 70 per cent of the larvæ of later generations of the diamond-back moth are commonly found parasitized by *A. plutellæ*. Other parasites reared by the author proved to be *Meteorus* sp., *Mesochorus* sp., and a new species of Microplitis. No parasites of the eggs or pupæ and no predaceous or fungus enemies have been observed. It is readily controlled by the use of arsenicals, of which Paris green 2 lbs. and soap 6 lbs. to 100 gals. of water is the most effective. Powdered arsenate of lead at the rate of 4 lbs. in 100 gal. of water is also effective.

The tobacco budworm and its control in the southern tobacco districts, A. C. MORGAN and F. L. McDONOUGH (*U. S. Dept. Agr., Farmers' Bul.* 819

(1917), pp. 11, figs. 2).—This lepidopteran (*Chloridea virescens*) is a very serious pest in the tobacco-growing sections of Florida, Georgia, Alabama, and Louisiana. Although common in North Carolina, South Carolina, and Virginia, it is much less injurious there than in the more southern part of its range and is rarely injurious in Kentucky and Tennessee. In addition to tobacco, the species has been recorded in the United States as attacking deer grass (*Rhexia virginica*), geranium, and ageratum, and has been reported to feed upon wild solanaceous plants, including ground cherry (*Physalis viscosa*) and other species of the same genus, and *Solanum sciglingae*.

Eggs are deposited singly on the leaves and in Florida during the growing season of tobacco hatch in from 3 to 5 days. The young larvæ migrate to and reach the buds in about 24 hours. Studies have shown the larval period to cover from 18 to 31 days during May and June, the pupal stage varying during the summer from 13 to 21 days. The emergence of adults from the ground is affected materially by moisture conditions, it having been observed that a great many moths often appear at the expiration of a dry period. In captivity moths laid an average of 334 eggs. The average duration of the life cycle during May and June, 1916, was determined to be 37.5 days.

A larval parasite (*Toxoneuron* sp.) is said to be its most important enemy. In control work 30 different insecticide formulas were tested during the seasons from 1913 to 1916. Of all the poisons used Paris green, arsenate of lead, and golden antimony sulphid applied directly to the bud with corn meal as a carrier gave the most promising results, there being, however, a great variation in the efficiency and cost in their application. A mixture of 1 lb. of arsenate of lead and 75 lbs. of corn meal has proved to be the most efficient combination, the loss from burning which follows the use of Paris green thus being eliminated. For the best results the buds must be treated twice a week until topping has been completed. Other supplementary control measures recommended include the removal from the field and destruction of suckers, 55 per cent of those removed having been found to be infested; the removal at the end of the season of the tobacco plants that remain standing in the fields; patching of holes in the cheesecloth and gates kept closed where tobacco is grown under cloth; destruction of plants left growing within and around old seed beds; and the covering and walling in of seed beds with cloth so as to prevent the entrance of moths.

Some recent advances in knowledge of the natural history and the control of mosquitoes, T. J. HEADLEE (*New Jersey Stas. Bul.* 306 (1916), pp. 5-26, figs. 10).—Reference is first made to the influence of salinity on the development of certain species of mosquito larvæ, an account of studies of which by Chidester has been noted (E. S. R., 37, p. 259). Studies in the laboratory and salt marsh have shown "that highly saline water (10 to 15 per cent) is favorable to the growth of the wrigglers of the white-banded salt-marsh mosquito (*Aedes sollicitans*) and injurious (deadly if sufficiently high) to the wrigglers of the brown salt-marsh mosquito (*A. cantator*), while only slightly salt water (6 to 8 per cent) is favorable to the latter and injurious to the former. The younger the larvæ the more acutely are they affected by the degree of salinity."

A method of rapidly tracing the migrating mosquitoes to their origin by use of an automobile, starting in uninfested territory close to the infested area and collecting at regular distances, 0.5 to 2 miles, until the mosquito zone had been traversed and uninfested country found on the other side, resulted in the discovery of the breeding places of many broods. This method is illustrated by a diagram. It was clearly shown in one case by collections between 8 and 9.30 p. m. that *Culex pipiens* migrated a distance of 2.5 miles from its

place of breeding, though as a matter of fact much study of this species on the wing indicates that except when bred in enormous numbers over many acres of sewage-charged water, the areas of great density are small and isolated from each other, showing clearly that slight, if any, migration, has taken place.

Drainage and the elimination of mosquito breeding areas are considered at some length under the headings of upland drainage, salt-marsh drainage, diking and tide-gating, and pumping.

The work with larvicides has seemed to indicate that fuel oil is the best for general use. Tests of sulphuric acid indicate that it can not have any great importance as a larvicide, while work with chlorin (bleaching powder) seems to show that it can not have more than a limited use. Electrolytic tests made of a machine consisting of a gasoline-engine-driven dynamo, connecting wires, and electrodes, in a meadow near Grasselli gave no evidence of their destruction of mosquito larvæ. In a test of niter cake it was found that the pupæ survived in a saturated solution.

The domestic flies of New Jersey, C. H. RICHARDSON (*New Jersey Stat. Bul.* 597 (1917), pp. 5-28, figs. 18).—A summary of information on the more important domestic flies, based upon studies conducted for the past three years at the station, the results of which have been previously noted (E. S. R., 32, pp. 60, 550; 34, p. 160; 36, p. 156).

The species concerned are the house fly, flesh flies, blow flies and allied species, the stable fly (*Muscina stabulans*), the little house fly (*Fannia canicularis*), the cluster fly (*Pollenia rudis*), etc. A summary of information on the breeding places of domestic flies, their eradication, a key to the common domestic flies of New Jersey, and a bibliography of 20 titles are included.

Some fly poisons for outdoor and hospital use, A. C. JACKSON and H. M. LEROY (*Bul. Ent. Research*, 7 (1917), No. 4, pp. 327-335).—"The fluorids, isolates, and salicylates are all excellent for indoor purposes and used at 1 per cent in sugar solution are not in any way dangerous or offensive. Formaldehyde is so uncertain that its use is not indicated when any other safe liquid can be employed; the reasons for the variability of its action are now under investigation. For hospital use, particularly, the very small quantity needed makes even the salicylates possible as useful fly poisons; an ounce of salicylate to 5 pints of water would poison flies for some time throughout quite a large hospital, and this amount could probably be spared. The fluorids are in use as indoor fly poisons in the Imperial College, where they successfully destroy flies that escape to the laboratories from the fly rooms."

The apple maggot in British Columbia, R. C. TREHERNE (*Canad. Ent.*, 49 (1917), No. 10, pp. 329, 330).—The author records the collection at Penticton, B. C., on July 26, 1916, of two adult flies of the apple maggot. This is said to be the first record of its collection in the Province of British Columbia and is practically an original record for the Pacific coast of North America.

The dipterous families Sepsidæ and Piophilidæ, A. L. MELANDER and A. SEELER (*Washington Sta. Bul.* 143 (1917), pp. 3-103, figs. 28).—In the present bulletin the authors deal with the flies commonly combined as the family Sepsidæ. These are of economic importance as they are principally scavengers, feeding and breeding in filth, sewage, excrement, carrion, and other decomposing vegetable or animal matter. A synopsis of the Sepsidæ is first presented (pp. 6-53), followed by a synopsis of the Piophilidæ. The authors recognize 61 species belonging to 18 genera, of which 19 are described as new.

A catalogue of described species is included.

Notes on some Buprestidae of northern California, W. J. CHAMBERLIN (*Ent. News*, 28 (1917), Nos. 3, pp. 129-139, figs. 10; 4, pp. 166-169).—These notes, which relate to 61 species, include data on their occurrence and hosts.

Biological investigation of *Sphenophorus callosus*, Z. P. METCALF (*North Carolina Sta. Tech. Bul.* 13 (1917), pp. 5-123, pl. 1, figs. 68).—Investigations of the southern corn bill bug commenced by the author in the spring of 1912 and carried on until the fall of 1915 are reported in connection with the earlier work by Smith, as previously noted (*E. S. R.*, 29, p. 56). The biologic and economic aspects of the investigation are dealt with, other phases of the problem being left for a later report. Much of the data is presented in tabular form.

Observations of its biology made in the southwestern part of the State, thought to apply throughout the area of its greatest abundance in North Carolina, have been summarized as follows: "The adults hibernate over winter, going into hibernation in late October (October 17 being the latest recorded date). They emerge from hibernation in mid-April (April 10 being the earliest date recorded). Their numbers seem to increase rather rapidly until late May, and after that rather slowly until mid-August. . . . After mid-August the numbers of adults diminish rapidly, so that in early corn practically all the adults have disappeared by the end of August. A few adults remain active to late October.

"The adults commence to lay eggs by early May (May 5 being the earliest recorded date). The number of eggs found in the field increases rather rapidly until mid-June and then less rapidly until mid-July, the number of eggs falling off slightly toward mid-August. After this the number decreases rather rapidly. The latest date recorded for finding eggs in the field is September 23, but as they were still rather common at that time, it seems safe to conclude that egg laying continues until early October, especially as the adults are active in the fields till late October.

"The distribution of the larvæ throughout the year seems to coincide rather closely with the distribution of the eggs. The earliest larvæ have been found in the field in mid-May, but the time of greatest abundance seems to be from late July to mid-August. After this time their numbers fall off rapidly, the latest larvæ being found in late October (larvæ in what appeared to be the fourth molt being found on October 27).

"The earliest pupæ have been found in late June. The number increases rather rapidly till late July and seems to remain nearly constant till late September, the latest pupa being found on November 9. These late-maturing pupæ seem to all change to adults before winter, and these adults seem to remain in the pupal cells over winter, not becoming active until the following spring. There is some evidence to show that the early maturing adults lay eggs the same summer that they reach maturity, these eggs hatching and reaching maturity late in the season."

The following are thought to be the most important factors involved in any system for the control of this pest, both from the standpoint of ease and cheapness of application: (1) Time of planting, (2) rotation of crops, (3) fertilization, (4) drainage, (5) ridging, (6) fall and winter plowing, (7) thorough cultivation, and (8) destruction of native food plants. These indirect measures are the only means of control, since the habits of the pest make it impossible to apply direct measures.

A bibliography of 17 titles is included.

An annotated list of the scolytid beetles of Oregon, W. J. CHAMBERLIN (*Canad. Ent.*, 49 (1917), Nos. 9, pp. 321-328; 10, pp. 353-356).—This list includes descriptions of seven new species.

Destruction of wheat by wasps, F. W. FROHAWK (*Entomologist*, 50 (1917), No. 649, pp. 132, 133, fig. 1).—*Vespa vulgaris*, a common wasp in England, is said to feed upon and damage the heads of wheat in that country.

The host of *Ablerus clisiocampæ*, B. A. PORTER (*Ent. News*, 28 (1917), No. 4, p. 186).—The author records the rearing of *A. clisiocampæ* in some numbers from the egg masses of the tent caterpillar, together with *Telenomus coloradensis*, *Tetrastichus malacosomæ*, and *Ooencyrtus* sp., of which *T. malacosomæ* was by far the most abundant.

A new West Indian chalcid fly, A. A. GIRAULT (*Canad. Ent.*, 49 (1917), No. 10, pp. 356, 357).—*Achrysocharella albitibiæ* n. sp. is described from a single female collected in St. Vincent.

Notes on *Perisierola emigrata*, a parasite of the pink bollworm, A. BUSCK (*Instructor Inscitæ Menstruus*, 5 (1917), No. 1-3, pp. 3-5).—These notes relate to observations in Hawaii of the species described as new and previously referred to as *Goniozus cellularis*, the larva of which is an external parasite of the full-grown pink bollworm. It was found to occur commonly in all the cotton fields on the island of Oahu and in the Kona cotton district of Hawaii, and is at present the only parasite of the pink bollworm of any importance. It is, however, by no means an effective check, and destroys only a small percentage of the cotton pest.

Notes on coccid-infesting Chalcidoidea, III, J. WATERSTON (*Bul. Ent. Research*, 7 (1917), No. 4, pp. 311-325, figs. 7).—This continuation of the article previously noted (*E. S. R.*, 37, p. 467) includes descriptions of three new species and one new variety from the West Coast of Africa.

Two new species of *Macrophya*, S. A. ROHWER (*Ent. News*, 28 (1917), No. 5, pp. 264-266).

The occurrence of the genus *Monobæus* in North America, A. A. GIRAULT (*Ent. News*, 28 (1917), No. 3, p. 106).—A new species, *Monobæus hegei*, is described from a female specimen from Michigan.

Notes on some parasites of sugar cane insects in Java, with descriptions of new Hymenoptera Chalcidoidea, A. A. GIRAULT (*Entomologist*, 50 (1917), No. 649, pp. 134-136).—Three parasites, probably of economic importance, are here described as new, namely, *Gonatocerus bifasciaticentrus* reared from eggs of a leafhopper embedded in the leaves of sugar cane; *Parachrysocharis javensis*, n. g. and n. sp., from *Flata affinis*; and *Cyrtogaster javensis*, from lepidopterous eggs.

The hothouse milliped, E. N. CONY and F. H. O'NEILL (*Maryland Sta. Bul.*, 296 (1917), pp. 283-294, figs. 3).—Reports received at various times attributing injuries to the hothouse milliped (*Oxidus gracilis*) and requests by florists and gardeners for information regarding its economic status led to the hothouse studies here reported.

This myriapod, a species of tropical origin widely distributed in temperate climates, is thought to have been introduced into the United States from Europe. Its distribution in this country seems to include the States along the Atlantic coast and as far west as the Mississippi Valley.

It is rarely seen during the day, being nocturnal in its habits. There appears to be but one generation a year, although the date of the oviposition period varies so much with individuals that specimens of all sizes may be found at almost any time.

The eggs are usually laid in the spring in masses, those counted containing from 9 to 327 eggs, and the average cluster containing from 175 to 250 eggs. The first eggs were observed on February 9, although the greatest number were found during April and May. The depth to which they are placed in the soil

varies with its nature and not in any special cavities in the soil or apparently with any relation to the proximity of food. In packed clay soil the depth to which the eggs were deposited varied from 0.5 to 1 in. below the surface, and in light sandy soil the average depth was from 1.5 to 2 in., although some few clusters were found as deep as 3 or even 4 in. below the surface. The eggs hatched in 20 days at a greenhouse temperature ranging from 58 to 76° F.

Five larval stages are described. The first stage has 5 pairs of legs and the succeeding larval stages 10, 20, 31, and 35 pairs, respectively. Roomy cells are formed in the earth in which they pass the molts.

Observations show that manure or decaying vegetable matter is the principal food of these millipeds. Experimental feedings indicate that they will not burrow in sand after the raw ends of cuttings or the newly formed roots, that they will not attack the stems of plants even under the stress of hunger, and that they can subsist for some time on the humus in the soil. The millipeds occasionally attack sprouting seeds, and it is believed that they can be starved into attacking the roots of some plants and under certain conditions may damage them to a limited extent.

The green alga that grows on moist flower pots appears to be an important source of food for this species. Observations indicate that it has predacious habits also, a half-grown milliped having been observed to attack and destroy a dipterous larva that was about 3 mm. long, and it was also observed to feed upon the remains of an earthworm, a green aphid, etc.

No parasites have been reared up to the present time but a small centipede is thought to attack it. In control work the authors' experiments with poison baits gave negative results, although they have been recommended as being efficient in some localities. Tests of tobacco products show that they are probably the best material for the control of the hothouse milliped. Tobacco dust sprinkled on the beds at the rate of 300 lbs. to the acre (1 oz. to 9 sq. ft.) has proved fairly effective, about 85 per cent of the millipeds on the beds being found dead the following day, although some apparently normal individuals were moving around through the dust, and only about 5 per cent of the millipeds below the surface were dead. Forty per cent nicotine sulphate was applied with good results at strengths varying from 1 part to 750 parts of water to 1 part to 1,000 parts of water. When applied at the weaker strength with a watering can until the soil of the beds was thoroughly drenched about 90 per cent were killed by the treatment, including nearly every milliped within 3 in. of the surface.

FOODS—HUMAN NUTRITION.

How to select foods.—II. Cereal foods, CAROLINE L. HUNT and HELM W. ARWATER (*U. S. Dept. Agr., Farmers' Bul. 817 (1917), pp. 23, figs. 5*).—Continuing previous work (*E. S. R.*, 37, p. 364), this publication deals with foods rich in starch and especially with the cereals and foods made from them.

Cereals, it is pointed out, are mild-flavored and comparatively inexpensive foods, which are very largely depended upon to yield energy to the body. In addition to this, they also yield varying but important amounts of tissue-building and body-regulating substances. Rightly combined with well-chosen food materials from other food groups, cereals can be safely used as the main part of the ration. Wisely planned, a diet in which cereals are so used can be made adequate, attractive, and at the same time economical.

Eggs in a thousand ways, A. MEYER (*Chicago: The Hotel Monthly Press. 1917. pp. 140*).—A compilation of recipes for the preparation of eggs for the table.

Milk as a food (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub., 1917], p. 1*).—A summary of data comparing milk and other foods.

How to use skim milk.—Ways in which this nutritious food material may be used to advantage in cookery (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub., 1917], p. 1*).—A summary of popular information with recipes.

Buttermilk a food drink (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub., 1917], pp. 2*).—A summary of data, with recipes.

The food value of American cheese (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub., 1917], pp. 2*).—A popular comparison of cheese with other foods.

Ways to use cottage cheese (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub., 1917], pp. 2*).—Popular information and recipes.

The nutritive value of edible fungi (*Jour. Bd. Agr. [London], 24 (1917), No. 4, pp. 416-419*).—A discussion of data in which the general conclusion is drawn that, while fungi can not be compared with meat or ranked with the essential foods, they should not be looked upon as absolutely worthless. They may be made to serve useful purposes as food accessories because of their agreeable flavor.

Cider fruit for table use, B. T. P. BARKER (*Jour. Bd. Agr. [London], 24 (1917), No. 4, pp. 394-402*).—The author concludes that, under present conditions, apples commonly used for cider should be used for cookery and the culls for jam making.

Botulism.—The danger of poisoning from vegetables canned by the cold-pack method, E. C. DICKSON (*Jour. Amer. Med. Assoc., 69 (1917), No. 12, pp. 965-968*).—The occurrence of a number of cases of botulism in the Pacific coast region led to a study of the possibility of conveying this disease by canned foods, especially those prepared by the cold-pack method. In experimental tests quart jars of peas, beans, and corn were inoculated with an emulsion containing spores of *Bacillus botulinus*, the jars of peas and beans being left in boiling water in a wash boiler for 120 minutes, and the jars of corn for 180 minutes. They were sealed immediately after removal from the boiler, inverted, and placed in a dark closet.

Within three weeks fermentation with the formation of gas was noted in all the jars. Some of the jars were leaking. On opening the jars a strong odor, resembling butyric acid, was noticed and cultures from all the jars showed a mixture of *B. botulinus* and *B. subtilis*.

Portions of the juice from all the jars were injected into guinea pigs and some of the canned peas were fed to a chicken. "All the guinea pigs died within 24 hours, and the chicken developed symptoms of limber-neck and died within 24 hours. A portion of the juice from the corn was passed through a diatomaceous filter and injected into a guinea pig, and the animal died within 24 hours. The symptoms of all the guinea pigs and of the chicken were identical with those produced by the toxin of the *B. botulinus* which is formed in meat broth."

The author believes that the experimental data reported prove that "the cold-pack method of canning vegetables is not efficient if the raw material happens to be contaminated with spores of the *B. botulinus*. The fact that both *B. subtilis* and *B. botulinus* were recovered in cultures from the contents of the jars proves that a single sterilization for the time recommended in the published directions is not sufficient to cause the destruction of spores. Fortunately, the number of spore-bearing bacteria which are responsible for producing poisonous changes in food is small, but the *B. botulinus* belongs to this small group, and since it is also an obligative anaerobe, the conditions which exist in the sealed jar or can are ideal for its growth and toxin formation."

In discussing the results it is also pointed out that the percentage of canned goods which would be normally infected with spores of *B. botulinus* would probably be small.

The practical conclusion drawn by the author is that "the botulinus toxin is easily destroyed by heating, and all danger of botulism will be removed from home-canned products if the food is always boiled before it is eaten or even tasted. Under no circumstances should home-canned vegetables which have been prepared by the cold-pack method be served as salad unless they have been cooked after their removal from the container, and, until it is established what fruits are suitable for the formation of the toxin, it will be safer to reheat all fruits which have been prepared by this method, even though there may be no apparent evidence that the food has spoiled."

Canned food safe (*U. S. Dept. Agr., Weekly News Letter*, 5 (1917), No. 36, p. 6).—The following statement prepared by bacteriologists of the Bureau of Chemistry and the States Relations Service has been issued:

"There is no danger that the type of food poisoning known as 'botulism' will result from eating fruits or vegetables which have been canned by any of the methods recommended by the U. S. Department of Agriculture, provided such directions have been followed carefully. It is possible that in a number of instances the directions were not strictly followed and that spoilage has occurred. Of course, extreme care should be taken to ascertain before eating canned goods of any kind whether they are in good condition, and if they have spoiled they should not be consumed.

"In case of any doubt as to whether the contents of a particular can have spoiled, the safest plan is to throw it away, although all danger of botulism may be avoided by boiling the contents of the can for a few minutes, since the *Bacillus botulinus* and the toxin or poison which it produces are killed by such treatment. No canned food of any kind which shows any signs of spoilage should ever be eaten. In the cold-pack method of canning given out by the Department of Agriculture, only fresh vegetables are recommended for canning, and sterilization is accomplished by the following processes: Cleansing, blanching, cold dipping, packing in clean hot jars, adding boiling water, sealing immediately, and then sterilizing the sealed jars at a minimum temperature of 212° F. for one to four hours, according to the character of the material. Since the spores of *B. botulinus* are killed by heating for one hour at 175° F. (according to Jordan's Bacteriology and other recognized textbooks) there is no reason to believe that the botulinus organism will survive such treatment."

Food supplies in war time, R. H. Rew (*London: Oxford University Press*, 1914, pp. 191).—A digest of data regarding the quantities of food available.

Utilization of food ([Columbus], Ohio: *Agr. Div. Ohio Branch Council Nat. Defense*, [1917], pp. 44).—This publication is prepared by the home economics department of the Ohio State University. Suggestions and recipes are given for the preparation of fresh and dried fruits, vegetables, salt fish, and cereals.

High cost of living (*Washington: Govt.*, 1917, pp. 119).—This is a report of the minutes of a conference of the Federal Trade Commission with delegates appointed by the governors of the several States to confer regarding food and fuel supplies and prices.

Report on the increased cost of living for an unskilled laborer's family in New York City (*New York: City*, 1917, pp. 32).—This publication reports the results of comparative studies made in February, 1915, and February, 1917, by the Bureau of Personal Service of the Board of Estimate and Apportionment, as to the cost of living for the family of an unskilled laborer, which consisted of two adults and three children aged 6, 10, and 13 years.

A survey of evidence regarding food allowances for healthy children, LUCY H. GILLET (N. Y. Assoc. Imp. Condition Poor Pub. 115 (1917), pp. 24).—This publication summarizes, under three headings, the evidence regarding the energy and protein requirements of children, consisting of (1) dietary studies, in which the weight of food eaten has been recorded for a given period of time and food values determined by analysis or calculated from average composition; (2) metabolism experiments, in which measurements have been made of the amount and composition of the food eaten and of the excretory products; and (3) respiration experiments in which the body heat has been estimated from the respiratory quotient.

A bibliography is appended.

The influence of diet on the heat production during mechanical work in the dog, G. LUSK (*Proc. Soc. Expt. Biol. and Med.*, 14 (1917), No. 5, pp. 92, 93).—The data here reported show that "when a dog runs at the rate of about 2½ miles an hour the heat production is almost exactly the same whether the dog has had no food or whether 70 gm. of glucose has been administered. In the resting dog 70 gm. of glucose would have increased the heat production 6 calories. The experiment proves the economical use of carbohydrate during periods of work. On the contrary, when 700 gm. of meat were given and the dog was compelled to run, the heat production was increased by that quota which would have been added from the specific dynamic action of the protein metabolized."

ANIMAL PRODUCTION.

Alfalfa silage, O. B. REED and J. B. FITCH (*Kansas Sta. Bul.* 217 (1917), pp. 12, figs. 2).—Experiments conducted in 1914 and 1915 on the preservation of alfalfa in silos are reported. The silos were 7 ft. in diameter and 16 ft. in height and held about 10 tons of silage each. One of the silos was filled each year with alfalfa alone, another with rye alone, and the others with alfalfa in combination with corn chop, blackstrap molasses, straw, sweet sorghum stover, or green rye. A palatability test was made each year to see how cattle would relish the various combinations. Chemical analyses were made each year of the silages and of the mixtures from which they were made.

The silos were filled in May, 1914, the alfalfa used being the first cutting, cut when about one-tenth in bloom, and they were opened in January, 1915. The results were not entirely satisfactory, due in part to the fact that there was not sufficient weight in the silos to cause thorough filling and packing and also to the fact that the silos were not entirely air-tight. In the palatability test silage from each of the silos was placed in a separate feed bunk in a feed lot to which 40 beef cattle had access. The cattle showed their preference for the mixtures in the following order: Alfalfa and molasses (17:1), alfalfa and corn chop (13:1), alfalfa alone, alfalfa and rye (15:1), alfalfa and molasses feed (11:1), alfalfa and straw (4:1), and rye alone. Analyses of the silage used in this test showed that the moisture content of all the silages was low with the exception of alfalfa and rye.

Before filling the silos the second year they were painted on the outside and inside, thick asphalt paint being used on the inside. In order to pack the silage more firmly and prevent such a large amount of silage from being spoiled, additional weight was obtained by placing bags of sand on top of the silage after the silos were filled. They were filled in the spring of 1916 and opened in December, after standing 8.5 months. There was only about 8 in. of spoiled silage on the surface of each silo, and the silage was in much better

condition than in the previous test. In a palatability test conducted for 12 days on the plan of the previous year the silage mixtures were preferred by the animals in the following order: Alfalfa-molasses (20:1), alfalfa-molasses (10:1), alfalfa and corn chop (10:1), alfalfa and rye (2:1), alfalfa and sweet sorghum stover (6:1), and alfalfa alone. Very little difference was shown between the first five mixtures. In a few cases the alfalfa and sorghum stover seemed to be preferred to the alfalfa and corn chop and alfalfa and rye silage. The poor quality of the sorghum stover accounts for the fact that the alfalfa and sorghum stover silage was not relished at times. The cattle ate very little of the alfalfa silage alone.

No attempt was made either year to determine the feeding value of the different mixtures used. A study of the chemical composition of the silages shows that both years those containing the highest percentage of acid were most palatable to the cattle, with the exception of rye alone.

Sudan grass silage. C. K. FRANCIS and W. G. FRIEDMANN (*Oklahoma Sta. Bul.* 115 (1917), pp. 8, figs. 21).—This bulletin gives results of experiments on the preservation of Sudan grass silage in a steel silo. The Sudan grass was cut when about one-sixth of the plants had reached the milk stage. The composition is given of Sudan grass hay as compared with other hays and of Sudan grass silage and corn silage. It is noted that the composition of Sudan grass silage is very similar to that of corn silage, except that the former averages about 33 per cent in fiber and the latter about 23 per cent.

Temperature records taken at several depths in the silo show that the maximum temperature was reached in about 21 to 30 days and that no great increases occurred thereafter. It is stated that the Sudan grass silage was fed to the college sheep and, "while proving a good feed, it did not appear to be relished by the animals so well as the corn silage, but quite as well as the made from other grain sorghums, and was relished much more in this form than as cured hay."

A study of methods of estimation of metabolic nitrogen. E. B. FORBES, C. E. MANGELS, and L. E. MORGAN (*U. S. Dept. Agr., Jour. Agr. Research*, 5 (1917), No. 12, pp. 795-799).—In the work reported, carried on at the Ohio Experiment Station, a basal ration of corn alone was fed to each of five pigs during the first period and nitrogenous supplements added to this corn ration in subsequent periods. In selecting the supplements an endeavor was made to choose foods the protein of which would probably be entirely digestible. Milk, blood albumin, and commercial dried egg albumin were used.

The analytical methods compared were the acid-pepsin method, the acid-pepsin and alkaline-pancreatin method, and the alcohol, ether, hot-water, and cold-lime water method suggested by Jordan.¹ In the first two methods it is assumed that by the use of digestive enzymes the nitrogen which has been digested, absorbed, and returned to the feces may be separated from the indigestible nitrogen, and that there is no further digestion during the course of the estimation of that part of the protein which escaped digestion in the alimentary tract of the experimental animal. It is noted that there is no means of proving the truth of this assumption. The experimental methods are described.

The results show that the apparent digestibility of corn, based on the total nitrogen of the feces, is about 75 per cent. The results of the acid-pepsin method make it appear that the real digestibility is about 92 per cent, and the pepsin-pancreatin method, about 93 per cent. Jordan's method yielded appreciably lower figures, averaging 86 per cent. The results of the acid-pepsin

¹ Maine Sta. Rpt. 1888, pp. 196, 197; abs. in U. S. Dept. Agr., Office Expt. Stas. Bul. 2 (1891), pt. 2, p. 60.

method indicate that 70 per cent of the nitrogen of the feces from corn is of metabolic origin, while those of the pepsin-pancreatin method and Jordan's method indicated 84 per cent and 46 per cent, respectively.

"All of the methods make the nitrogen of blood albumin appear more than completely digestible, even the apparent digestibility being over 100 per cent; thus, the feeding of blood albumin with corn seems to increase the digestibility of the corn protein to an extent more than sufficient to offset the incompleteness of digestibility of the protein of this supplement."

The apparent digestibility of skim milk varied from 93.97 to 104.44 per cent, the average being 99.15. The proteins of skim milk appear to be more nearly completely digestible by the acid-pepsin method than by the other methods.

It is indicated that "important inaccuracy seems to be inevitable in any determination of digestibility of supplementary foods in the usual way, by difference; and no other method seems more satisfactory. This applies equally to comparisons of real digestibility and of apparent digestibility (based on total nitrogen of the feces). The digestion coefficients for protein involved in the feeding standards of our reference works on animal production assume that the nitrogen of the feces is entirely an indigestible food residue. The rough measures afforded by the results of this study indicate that, as applying to the digestive capacities of swine, this assumption underestimates the digestibility of protein by about 20 per cent."

No significant differences were observed in the study of the effects on metabolic nitrogen of storage of the feces in a frozen condition for 20 days, with or without the addition of thymol, or air-drying the fresh material with or without thymol.

The acid-pepsin and the pepsin-pancreatin methods are considered to give results which are more nearly true than does Jordan's method. The latter does not digest the bacteria which may contain large proportions of the nitrogen of the feces and which presumably are more largely the product of digestible than of indigestible protein. The lack of an accurate scientific basis for the determination of the digestibility of protein is noted.

A study of the rate of passage of feed residues through the steer and its influence on digestion coefficients. P. V. EWING and F. H. SMITH (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 2, pp. 55-63).—In the investigations here reported, which were made at the Georgia Experiment Station, the attempt was made (1) to determine by means of digestion experiments the relationship between the moisture content of the feces and the digestion coefficients in order to see if there is a correlation between the time required for the passage of the feed through the animal and the moisture content of the feces, (2) to follow more closely and directly by means of rubber markers the time required for passage of the feed residues through the steers, and (3) to determine the rate of passage by means of calculations based upon the intake of food and output of feces and the alimentary tract contents as ascertained on slaughtering.

In studying the problem by the first method essentially the digestion experiments already noted (*E. S. R.*, 34, p. 169) were repeated. To avoid the complications in the calculations and results which would arise if comparisons were made of the data obtained while on different rations, studies were made on the correlations between the high and low moisture contents of the feces and the corresponding digestion coefficients where the same rations were employed. The correlations, as obtained from the results of the two series of digestion experiments each made in duplicate, indicate that with a higher moisture content of the feces there is a more complete digestion of all nutrients except nitrogen and fat. Commenting on the weakness of this method the authors state that "it

still remains to be proved definitely that the rate of passage of feed residue through the steer can be measured by the moisture content of the feces. Our work has shown that if a high moisture content of the feces is indicative of rapid passage then the apparent digestion is more complete probably for all the nutrients with the more rapid passage and less complete with the slower movement. Unfortunately, the method of study shows only the relationship and not the extent of the variation in digestion associated with a high moisture content."

In studying the problem by the second method soft rubber discs cut from heavy rubber tubing were fed at the beginning of a ten-day digestion trial and a count was made of them as they appeared in the feces. Some of the indicators appeared within 12 hours, while others were recovered as late as 60 days following, and still others never came out until the steers were slaughtered. While this method proved impractical, the slaughter tests showed that hard particles of feed and foreign substances were especially prone to become delayed in transit either in the reticulum, in the fourth, or true, stomach, or in the first few ventral folds of the duodenum. The coarse feeds and roughages retard the rate of passage of feed residues, a point proved conclusively by the slaughter tests. In connection with this method the use of 60 or 120 grm. per steer daily of calcium carbonate or magnesium sulphate exerted no appreciable effect upon the rate of passage of feed residue or upon the digestion coefficients.

Studying the problem by the third method, an accurate measure of the time required for the passage of the residue of feed was obtained by use of a formula. The inaccuracies of the method arising from certain metabolic processes are recognized, but it is stated that their influence would be no greater on these results than on the digestion coefficients, if as much.

The data obtained by this method indicate that with the rations used and the quantities fed the time required for the passage of the feed residues through the animals varied from 2.9 to 5.2 days. "The two most important factors determining the rate of passage are the nature of the ration and the amount fed. Coarse roughages seem to require a considerably greater time than the more finely ground concentrated feeds. . . . As to the influence of quantity, it appears that, when the coarse feeds were fed, a smaller quantity required a greater time for passage of the residues, but when the feed was a concentrate in pulverized form the variation was not so pronounced. . . . In dealing with the influence which the rate of passage of the feed residue may have had on the digestion coefficients we are unable definitely to attribute changes to the rate of passage, and at best it can only be said that associated with the more rapid passage there occurred an apparent gain in the digestibility of the ash, negligible results in the case of nitrogen, a decided loss in the digestibility of the crude fiber, a gain in the case of the nitrogen-free extract, and negligible results in the case of fat."

[Feeding experiments with beef cattle], D. T. GRAY (*North Carolina Sta. Rpt. 1916, pp. 31-34*).—To ascertain the best feed for wintering stock cattle, 67 grade steers were fed varying amounts of cottonseed meal and corn silage for 148 days at the station farm during the winter of 1915-16. The steers in lot 1 were fed an average daily ration of 20 lbs. of corn silage and 1 lb. of cottonseed meal, those in lot 2 an average ration of 23 lbs. of corn silage, those in lot 3 an average ration of 20 lbs. of corn silage, and those in lot 4 an average ration of 20 lbs. of corn silage and 0.5 lb. of cottonseed meal. During the last 44 days of the experiment all the lots also received 5 lbs. of corn stover per head daily. The steers in the first lot lost 16.2 lbs. during the entire

period, those in the second lot 52.9 lbs., those in the third lot 72.2 lbs., and those in the fourth lot 69.4 lbs.

In a similar experiment at the Fredell substation one lot of steers wintered on a daily ration of 20 lbs. of corn silage and 1 lb. of cottonseed meal gained 24 lbs. per head in 100 days. Another lot on a daily ration of 20 lbs. of corn silage alone lost 55 lbs. per head during the same period.

Work was carried on at the Edgecombe substation during the past winter to determine the best feeds for wintering beef calves, especially to see if cottonseed meal could be fed profitably. One lot of calves averaging 340 lbs. each in weight gained 19 lbs. per head in 98 days on an average daily ration of 15 lbs. of corn silage and 1 lb. of cottonseed meal. Another lot averaging 321 lbs. each in weight lost 16 lbs. per head during the same period on an average daily ration of 15 lbs. of corn silage alone. With silage at \$4 and cottonseed meal at \$6 per ton, the respective feed costs per calf were \$4.90 and \$2.94. The cottonseed meal did not injure the calves in any way.

At the station farm the attempt is being made to determine the amounts of cottonseed meal that can be safely fed to growing calves, with special reference to the kinds of roughage and antidotes. During the past winter 20 grade Jersey calves weighing from 150 to 450 lbs. each were divided into four lots and fed the following daily rations: Lot 1, cottonseed hulls and 1 lb. of cottonseed meal per 100 lbs. live weight; lot 2, cottonseed hulls and 1 lb. per 100 lbs. live weight of a mixture of cracked corn and cottonseed meal (1:1); lot 3, a mixture of beet pulp and cottonseed hulls and 1 lb. of cottonseed meal per 100 lbs. live weight; and lot 4, the same as lot 1 plus 1 qt. of iron sulphate solution per pound of cottonseed meal. This experiment was closed May 1, as one of the calves in the third lot died on April 12 as a result of cottonseed-meal poisoning and several of the other calves were losing their sight. The calves in lots 2, 3, and 4 were then turned on pasture and weighed again on October 31. All of them showed subsequent gains for the summer, and their eyes had apparently entirely recovered from the trouble. A repetition of the above experiment ended with practically the same results.

In a cooperative experiment in Haywood County the attempt is being made to solve the problem of maintaining beef cattle through the winter with a view to finishing on pasture the subsequent summer. During the past winter 114 stockers were divided into five lots and wintered for 119 days as follows: Lot 1 was fed a daily ration of 3.15 lbs. of ear corn and 11.4 lbs. of a mixture of corn stover, hay, and straw; lots 2 and 3, a daily ration of 18 lbs. of corn silage and 6 lbs. of the hay mixture; lot 4, pasture alone; and lot 5, which consisted of calves averaging 270 lbs. each in weight, a ration of 0.5 lb. of shelled corn and 0.5 lb. of cottonseed cake. The stockers in lots 1, 2, 3, and 4 averaged from 592 to 813 lbs. each in weight. During the winter the cattle in the first three lots lost in weight 34, 41, and 40 lbs., respectively, per head, while those on pasture alone gained 26 lbs. each. The calves gained 9 lbs. each. Counting pasture at \$1 a month per animal and the other feeds at local prices, it cost \$12.14 to winter each steer in the first lot, \$7 in lots 2 and 3, \$5.30 in the winter pasture lot, and \$4.18 to feed each one of the calves.

The cattle were placed on summer pasture from April 13 until August 31, 1917 also receiving 4 lbs. of cottonseed cake per head daily. All the steers made good gains, but those fed cottonseed cake did not make much more rapid gains than those on pasture alone and it did not pay to feed it. The steers in lots 2, 3 and 4 yielded a net profit of \$21.63, \$20.94, and \$24.02 per head, respectively, while the steers in lot 1 yielded a net profit of only \$13.01 each.

Sheep. D. T. GRAY (*North Carolina Sta. Rpt. 1916*, pp. 34, 35, 36).—Two years' work on the effect of cottonseed meal upon the health and reproductive organs of breeding ewes showed no detrimental results from a ration of cottonseed meal and cracked corn (2:1). In the work of crossing Barbado sheep with those of the Shropshire and Merino blood, wool from the cross-bred animals was sold the past season for the same price as the wool from the Shropshire and Merino ewes. The Barbado sheep have not proved immune to the ravages of the stomach worm.

At the Fredell substation a lot of breeding ewes kept in shed or corral during the winter of 1915-16 and fed corn silage and a mixture of cracked corn, cottonseed meal, and wheat bran (2:1:1) gained about 5 lbs. per head. Another lot pastured during the winter on a meadow from which hay had been cut gained 20 lbs. each. The cost of wintering the barn-fed ewes was about twice that of the lot on pasture. In the spring the ewes were all sheared, the wool selling at 36 cts. per pound, or \$2.90 per ewe, which was about the cost of wintering ewes on good pasture.

The management of farm flocks in Idaho. E. J. IDOLING (*Idaho Bul. 96 (1917)*, pp. 29, figs. 9).—This bulletin gives general information and suggestions for the management of farm flocks of sheep under Idaho conditions.

Are sheep profitable in winter? C. D. WOPPS (*Maine Sta. Bul. 260 (1917)*, pp. 86-92).—A two years' progress report is given of the experiment with grade Hampshire sheep at Highmoor farm, already noted (*E. S. R.*, 33, p. 73).

On the flock of 73 ewes, 3 rams, and 22 ewe lambs there was a loss of \$375.55 during the year ended October 31, 1915, the estimated value of manure being credited. During the year ended October 31, 1916, the flock was kept at a loss of \$207.56, no account being taken of manure, or allowing full value for manure and omitting overhead charges, a credit balance of about \$100 on the flock for 1915-16.

Family performance as a basis for selection in sheep. W. C. RITZMAN and C. B. DAVENPORT (*U. S. Dept. Agr., Jour. Agr. Research. 10 (1917)*, No. 2, pp. 93-97).—An outline is given of a system of selection on the basis of family performance being used in sheep-breeding work at the New Hampshire Experiment Station.

By "family" is meant the brothers and sisters and the two parents of the individual being studied. The aim of these breeding experiments being to produce a race of sheep that will combine good qualities of conformation, size, and wool, weights are assigned to various quantities which are thought to be correlated with the traits that are desired. The families from which individuals are to be selected are rated according to the average weights obtained in grading. In the selection of breeding rams, if the individual belonging to the "best" family is sickly or has any physiological quality that would interfere with its success as a breeder, the male from the next higher family may be preferred; that is, selection is made primarily on the basis of family performance, but the somatic insufficiency of the individual is permitted to veto the choice based on family alone. It has been found, however, that the best individuals usually come from the families that stand high in the scale.

The use of the method is illustrated in a particular case. The experiment has not yet proceeded far enough to show definite results, but the authors state that "the uniformity of the progeny and the high quality already shown by the earlier generations give us every reason for confidence that this method of selecting by family performance in place of individual traits is well worth the extra trouble it entails, if, indeed, it is not indispensable."

Digestion experiments with pigs, with special reference to the influence of one feed upon another, and to the individuality of pigs. H. S. GRINDLEY, W. J. CARMICHAEL, and C. I. NEWLIN (*Illinois Sta. Bul.* 200 (1917), pp. 55-94, 220, figs.).—The objects of the experiments reported in this bulletin were (1) to determine the influence of one feed upon the digestibility of the nutrients of another feed, (2) to study the individuality of pigs as to the thoroughness with which they digest their feed, and (3) to determine the coefficients of digestibility of the nutrients of the following rations: Wheat middlings, ground corn, ground barley, wheat middlings and ground corn (1:1), ground barley and ground corn (1:1), and tankage and ground corn (1:7.5). The feeding stalls used in these experiments were large enough to allow the pigs to turn around freely and were raised some 3 ft. from the floor to enable an easy collection of the urine. The feces were collected in rubber-lined canvas bags held in place by specially constructed harness. Illustrations are given of the digestion harness and of the feeding stalls.

Each of the rations was fed for two 10-day periods. Each test period was preceded by a preliminary period of from 25 to 32 days during which the pigs were accustomed to the test rations and to the stalls and harness. Four 7-month-old pigs were used in each of the series, those in 1913-14 being cross-bred Berkshire-Chester Whites, all from the same litter, and those in 1914-15 cross-bred Duroc Jersey-Poland Chinas, all from the same litter. Analyses are given of the feeds and feces.

The following table gives the average coefficients of digestibility of the rations fed in these experiments:

Digestion coefficients of rations when fed to swine.

Ration.	Number of experiments.	Dry substance.	Protein.	Ether extract.	Nitrogen free extract.	Coef. digest.
		Percent.	Percent.	Percent.	Percent.	Percent.
Wheat middlings.....	16	74.4	80.9	86.4	87.2	21.0
Ground corn.....	16	87.1	71.5	68.3	59.1	34.8
Ground barley.....	8	79.8	75.0	43.0	64.2	14.1
Wheat middlings and ground corn (1:1).....	8	79.1	77.3	83.1	87.9	12.1
Ground barley and ground corn (1:1).....	8	80.9	66.7	66.8	88.9	15.0
Tankage and ground corn (1:7.5).....	16	86.0	71.8	80.8	92.2	51.2

In discussing the influence of one feed upon the digestibility of another feed as indicated by results obtained in these experiments, the authors conclude, "First, that the coefficients of digestibility of feeds calculated indirectly by subtracting the weights of the digestible nutrients of one feed as directly determined in other periods from the corresponding values for two feeds combined may be and probably often are, decidedly inaccurate, and, second, that the weights of the digestible nutrients of a mixed ration calculated by the use of the coefficients of digestibility of the nutrients obtained directly for the individual feeds when fed alone may be decidedly inaccurate. It, therefore, seems evident from these considerations that, in order to obtain accurate results for the coefficients of digestibility of mixed rations, digestion experiments should be made directly upon the mixed rations as fed. In other words, in the future, coefficients of digestibility of the nutrients for mixed rations should be obtained and reported, rather than merely those for the individual feeds composing the rations."

The following table is a summary of the average results, which show the influence of one feed upon the digestibility of another feed:

Coefficients of digestibility of feeds, directly and indirectly determined:

Ration.	Number of experiments.	Dry substance.	Protein.	Ether extract.	Nitrogen-free extract.	Crude fiber
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Middlings direct.....	8	74.7	73.3	82.3	82.2	22.4
Middlings indirect.....	8	70.7	74.3	80.3	77.2	24.1
Corn direct.....	8	87.8	78.1	71.7	92.7	36.4
Corn indirect.....	8	83.7	73.0	81.3	88.9	21.2
Barley direct.....	8	70.8	84.0	83.0	81.2	14.1
Barley indirect.....	8	76.1	60.2	68.9	66.2	2.2
Corn direct.....	8	98.2	74.0	64.9	91.5	38.8
Corn indirect.....	8	91.8	81.4	68.7	96.6	15.0
Middlings and corn direct.....	8	79.1	77.3	83.5	86.0	12.3
Middlings and corn indirect.....	8	81.1	78.0	78.8	86.1	28.8
Middlings and corn indirect.....	8	77.1	76.0	88.1	83.8	10.7
Barley and corn direct.....	8	80.9	66.5	67.8	88.9	1.0
Barley and corn indirect.....	8	78.3	63.2	54.0	86.3	29.1
Barley and corn indirect.....	8	83.7	69.9	80.7	91.3	6.0

* Calculated from direct determinations of coefficients of individual feeds.

† Calculated from indirect determinations of coefficients of individual feeds.

Data are also tabulated showing the thoroughness with which each pig digested its feeds, from which it is concluded that "under conditions that are practically identical throughout the same experiment, the coefficients of digestibility of the nutrients of a number of different rations show significantly higher values for some pigs than for others. However, the differences in the coefficients of digestibility of the nutrients of the same feeds by the different pigs are probably too small to be considered of much, if any, practical or economic importance."

The digestibility of some Arkansas feeds for hogs. J. B. RATHER (Arkansas Sta. Bul. 153 (1917), pp. 16, fig. 1).—The results of digestion experiments on hogs are reported, including analyses of the feeds and a description of the digestion crate used in the experiments. The following table gives the coefficients of digestibility as determined:

Coefficients of digestibility of various feeding stuffs.

Number of trials.	Kind of feed.	Protein.	Ether extract.	Crude fiber.	Nitrogen-free extract.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
4	Corn chop.....	82.37	70.75	42.38	93.28
4	Cottonseed meal.....	79.53	85.04	39.56	93.34
2	Soft corn.....	77.14	62.14	67.31	95.22
2	Cats.....	78.37	88.29	21.88	78.44
1	Wheat bran.....	76.26	80.30	19.23	86.28
2	Wheat shorts.....	85.83	79.93	34.89	87.21
2	Rye bran.....	75.09	86.49	20.62	87.21
2	Rice polish.....	87.49	87.07	53.21	95.22

Pork production on irrigated lands in western Nebraska. J. A. HOLDEN (Nebraska Sta. Bul. 159 (1917), pp. 4-51, figs. 3).—Results of grazing experiments with hogs at the Scottsbluff experiment farm from 1912 to 1916, inclusive, are reported. Results secured from 1912 to 1915, inclusive, have been noted from another source (E. S. R., 36, p. 767).

In 1916 corn and ground barley were compared as supplements for alfalfa pasture. Although the one acre of pasture on which these tests were made was severely damaged by wind and hail storms, the results were fairly satisfactory and added strength to the previous years' data which showed that ground barley is equal to shelled corn as a hog feed. For the entire season the gain from the corn lot was 3,142 lbs., and from the barley lot 2,701 lbs. The corn lot consumed 2.74 lbs. of corn and the barley lot 2.92 lbs. of ground barley for each pound of gain made. When the gains made are figured at 7 cts. per pound and the lots charged \$1.07 per hundredweight for corn and \$1 for ground barley, the net returns for the one-acre alfalfa pastures were \$127.84 where corn was fed and \$110.11 where barley was fed. The pasture of the barley lot, however, was more severely damaged by the windstorms and one of the shoats in this lot became sick 28 days after the experiment began and was removed.

Sows and their litters grazed on alfalfa pasture with 2 lbs. of corn per 100 lbs. of live weight made a gain of 1,285 lbs. and a net return of \$57.20 per acre in 1916. The average for the five years in these tests, in one of which barley was used instead of corn, was 1,516 lbs. of gain and a net profit of \$63.11 per acre.

In an experiment which lasted two months in 1916 where corn and alfalfa pasture were compared with corn alone in a dry lot for finishing shoats for market, 14 acres of pasture supplemented with 9,677 lbs. of corn produced 2,467 lbs. of pork, and 11,300 lbs. of corn on dry lot produced 2,202 lbs. of pork, or a gain of 25.8 lbs. on pasture and 19.5 lbs. on dry lot per 100 lbs. of corn.

Results in 1916 in hogging corn without supplementary feed showed a gain of \$40 lbs. of pork worth \$58.80 per acre, or \$1.56 per hundredweight for the estimated yield of corn. The average gain per acre in four years of these tests was \$82 lbs. of pork worth \$61.74 per acre, or \$1.52 per hundredweight of the estimated yield of corn.

Feeding experiments with pigs], D. T. GRAY (*North Carolina Sta. Rpt. 1916, pp. 23-31*).—At the Edgecombe substation 18 pigs weighing 87 lbs. each were pastured on 5 acres of soy beans for 60 days. In addition to the pasture they received a small amount of corn and tankage (9:1). As a check 3 pigs were fed a full ration of corn and tankage (9:1) on dry lot. The pigs on soy-bean pasture gained 1.38 lbs. per head daily at a cost of 4.96 cts. per pound of gain and returned a value of \$19.25 per acre for the soy beans, the yield of which was below normal. The pigs on dry lot gained 1.28 lbs. each daily at a cost of 5.6 cts. per pound of gain.

To determine the relative value of peanuts and soy beans as grazing crops for pigs, 1.65 acres of soy beans and 1.72 acres of peanuts were planted in the spring of 1915 at the Pender substation. Nine pigs averaging 112 lbs. each were turned into each field September 16 and given a half ration of corn. The soy beans afforded feed for the 9 pigs for 61 days, but an equivalent area of peanuts afforded grazing only 36 days. The soy bean-fed pigs gained an average of 0.38 lb. per head daily at a cost of 5.2 cts. per pound of gain. The peanut-fed pigs gained 1.36 lbs. per head daily at a cost of 5.41 cts. per pound of gain. Deducting the cost of grain the soy beans produced \$18.80 and the peanuts \$16.61 worth of pork per acre.

In an experiment to test the relative value of peanuts damaged in the shock and peanut meal for pigs at Edgecombe, 30 pigs averaging 98 lbs. each were divided into three lots and fed for 149 days, beginning January 25, 1916. The pigs in the first lot were fed a ration of corn and shorts (2:1), those in the second lot corn and damaged peanuts (2:1), and those in the third lot a ration of corn and peanut meal (2:1). Those in the first lot gained 0.69 lb. per head daily at a cost of 10.35 cts. per pound of gain, those in the second lot 0.71 lb. at a cost of 9.83 cts., and those in the third lot 0.81 lb. at a cost of 8.81 cts.

The waste peanuts were marketed by means of these hogs at more than 75 cts. per bushel.

In a preliminary experiment at the main station as to the relative value of wheat shorts, soy-bean meal, and peanut meal as supplements for corn, pigs averaging about 43 lbs. each were fed for 140 days in very small cement-floored lots. The pigs fed corn and shorts (2:1) gained an average of 0.29 lb. per head per day at a cost of 19.8 cts. per pound of gain, those fed corn and soy-bean meal (2:1) gained 0.44 lb. at a cost of 11.79 cts., and those fed corn and peanut meal (2:1) gained 0.37 lb. at a cost of 14.56 cts. In this test corn was valued at \$1 a bushel, soy-bean meal at \$40 a ton, and peanut meal at \$30 a ton.

Continuing the work on the use of iron sulphate and citrate of iron and ammonia to neutralize the effects of cottonseed meal upon hogs (E. S. R., 34, p. 79), it was found that while these chemicals did not completely overcome the toxic effects of cottonseed meal, gains were more satisfactory where they were used.

Tests were made on the feed and labor cost of raising pigs to weaning time at eight weeks of age. At Edgcombe with sows that raised an average of 5½ pigs the cost was \$1.94 per pig and the weight at weaning time averaged 24.3 lbs. At Pender the sows raised an average of 6½ pigs each, averaging 28.8 lbs. each in weight and \$3.34 in cost at weaning time. At the Iredell substation the sows raised an average of 6½ pigs each, averaging 31.8 lbs. in weight and cost \$2.24 each.

Extensive experiments are being made by the station on the softening effects of peanuts, soy beans, and mast upon the fat of hogs. In this work corn-fed hogs are used as a standard, it having been found that the melting point of the lard from the kidney fat of hogs fattened on corn alone is approximately 43° C. In a cooperative experiment hogs were grazed on waste peanuts for 82 days, at the end of which time their bodies were very soft. During the finishing or hardening period of 26 days the hogs were fed on corn alone and corn in combination with various amounts of cottonseed meal, but in none of the lots was the average melting point of the leaf lard of these hogs as high as 40° after the hardening period. At Pender a lot of pigs was grazed on soy-bean pasture supplemented with a partial ration of corn for 61 days, when the melting point of the leaf lard of two of the pigs averaged 37°. The remaining pigs were finished for 41 days on corn alone, and the average melting point of the leaf lard of these pigs was 39.8°. With another lot pastured on peanuts and fed some corn in addition for 36 days the average melting point was 33.4°, while the remaining pigs of this lot, after being finished for 66 days on corn alone, showed a melting point of 37.2°. At Edgcombe the leaf fat of pigs fed in dry lot on corn and tankage (9:1) for 60 days had a melting point of 43.3°, while in other pigs fed this ration supplemented with soy-bean pasture for 60 days it was 33.3°. The remaining pigs in the soy-bean lot were finished in dry lots for 21 days, when the lards taken from those finished on corn and tankage had a melting point of 35.6°, and from those finished on corn and cottonseed meal 33.5°. The results of more recent work indicate that soft-bodied hogs can be brought back to normal in from 32 to 49 days when corn is fed in conjunction with cottonseed meal.

Are swine profitable in winter? C. D. Woods (*Maine Sta. Bul.* 269 (1917), pp. 92-94).—In an experiment on the care of manure noted on page 628, it was necessary to keep the manure well worked over and compacted to prevent losses from heating. The experiment here reported was undertaken to determine whether swine would perform this work.

A brood sow and 14 2-months-old pigs were placed on the manure December 1, 1915, and were kept there until June 7, 1916. They were fed cooked turnips and ground feed, and some whole corn was scattered over the manure at times

to keep the swine at work stirring the manure. Reckoning the turnips at 15 cts. per bushel, corn at \$30 per ton, corn meal at \$31 per ton, middlings at \$27 per ton, and labor at 15 cts. per hour, and crediting the sow and shoats at the end of the experiment at 8 cts. per pound, live weight, increased by a litter of 8 pigs at \$2 each, and \$27 for manure, there was a profit of \$23.68, or a return of 15 per cent on the whole investment. Moreover, the manure in the pit was thoroughly worked and in excellent shape for application to the land.

Orokinase and salivary digestion studies in the horse. C. C. PALMER, A. L. ANDERSON, W. E. PETERSON, and A. W. MALCOMSON (*Amer. Jour. Physiol.*, 43 (1917), No. 3, pp. 457-474).—The name orokinase is proposed by the senior author, at the Minnesota Experiment Station, for the enzyme produced in the mouth and found in the saliva which activates the saliva of the horse. Saliva obtained from the parotid ducts or extracts of the salivary gland was found not to digest starch, while mixed mouth secretions obtained from an esophageal fistula were found to have a very powerful amylolytic action. The amylolytic action of mixed horse saliva was equal to that of human saliva on cooked starches and greater on raw starches. The saliva collected from the mouth was hardly ever as powerful as that obtained from an esophageal fistula.

Attempts were made to activate artificially fistula saliva or gland extracts, but these were unsuccessful. The gland extracts, however, became self-active with age. Considerable reducing sugar in food caught from an esophageal fistula a few minutes after feeding a diet of raw corn and oats was demonstrated. It is noted that "salivary digestion started in the mouth is very likely continued in the stomach, and this digestion is more important in the horse than most investigators have been lead to believe."

The amylolytic action of parotid fistula saliva was studied by methods previously noted by Palmer (*E. S. R.*, 36, p. S24).

[**Cottonseed meal for work horses and mules.**] D. T. GRAY (*North Carolina Sta. Rpt. 1916*, pp. 46, 47).—At the Fredell, Pender, and Edgecombe substations the work horses and mules have been divided into two lots, one lot receiving no cottonseed meal and the other lot the same kind of ration, except that cottonseed meal makes up a part.

It has been found that "while cottonseed meal can be used in very limited amounts, we can not, as a rule, induce a horse or mule to use more than 1 lb. a day for any length of time. This 1 lb., however, has proved to be an economical addition to the ration, and has also had much to do with maintaining the horses and mules in better condition. The saving in money, however, is not the chief advantage in using cottonseed meal, or at least it does not appear so at the present time. It seems that the chief advantage will be that the horses which eat cottonseed meal stay in better condition. This is indicated plainly during the spring months, as the animals which eat cottonseed meal shed off earlier and smoother than those which do not eat it."

Licensed stallions in Utah during the season of 1916. W. E. CARROLL (*Utah Sta. Circ.* 24 (1917), pp. 3-25, fig. 1).—Tables are given showing the distribution of licensed stallions and jacks in the State, the number of licensed animals in each county and the percentage which are pure bred, and the distribution among the various breeds.

[**Poultry investigations.**] D. T. GRAY (*North Carolina Sta. Rpt. 1916*, pp. 45-55).—In tests on the cost of raising chicks to eight weeks of age it was found that to produce 1 lb. of gain with the Mediterranean and Continental breeds it required 2 lbs. of feed, and with the English and American breeds 2.1 lbs. of feed. At the end of eight weeks chicks of the former classes averaged 12 lbs. in weight, while those from the latter classes averaged 1.6 lbs. It cost slightly over 8 cts. per pound to produce gains in all the breeds.

In fertility experiments it was found that ordinarily from 80 to 90 per cent of the eggs are fertile when cocks are continually with the hens, and from 80 to 90 per cent of these eggs hatch. When cocks were removed from the hens the fertility of the eggs declined rapidly, no fertile eggs being found after from 15 to 18 days. When cocks were placed with laying hens fertile eggs began to appear after the fifth or sixth day.

An experiment was begun November 1, 1915, with three lots of hens to determine the effects of continued feeding of cottonseed meal upon the health, vigor, and egg production. Rations were fed made up of 30 per cent, 5 per cent, and no cottonseed meal, respectively. During the first year 26, 12, and 10 per cent of the respective flocks died. There has not been so far a marked difference in the amount of eggs produced.

Eight different breeds and some mixed lots were compared as to the amount of feeds eaten, the cost of feeds, and the amount of manure produced. Of the breeds tested, the Silver Campines consumed the least amount of feeds. In cost of eggs produced, the Buff Plymouth Rock was the most expensive breed. In this test the hens produced an average of 22 lbs. of manure per head per year.

In experiments in marketing eggs by parcel post and express it was found that such materials as sawdust, bran, and cottonseed hulls pack so closely that there is not sufficient spring to the material about the eggs, and about 10 per cent of the eggs are broken in transit. These materials were particularly unsatisfactory when breeding eggs were shipped. When the eggs were wrapped in soft paper, felt, moss, or prairie hay very few were broken.

At the Pender substation soy-bean meal practically took the place of rolled oats for chicks and was much cheaper. At the Edgecombe substation peanut meal proved a valuable feed for young chicks up to eight weeks of age. Chicks fed a ration of peanut meal, corn meal, and ground oats (1:1:1) and butter-milk weighed an average of a little over 1 lb. each at eight weeks of age, while those fed a similar ration with peanut meal omitted weighed only 0.7 lb. each.

Preparing poultry produce for market, F. G. ELFORD (*Canada Expt. Farms Bul. 88 (1916), pp. 31, pl. 1, figs. 19*).—In addition to notes on the need and value of preparing poultry for market and systems of marketing, this bulletin contains general directions for packing and shipping market eggs, for crate feeding, killing, plucking, packing, and marketing poultry, and for crating and shipping breeding stock and eggs for hatching.

Preserving eggs for home use, G. S. TEMPLETON (*Alabama Sta. Circ. 36 (1917), pp. 39-42, fig. 1*).—Brief directions are given for preserving eggs in water glass or sodium silicate.

DAIRY FARMING—DAIRYING.

Dairy investigational work, D. T. GRAY (*North Carolina Sta. Rpt. 1916, pp. 56-60*).—Work has been carried on at the Pender substation for three years to determine the value of corn silage for milk cows. During the three winters the cows fed silage have produced 3,873 lbs. of milk more than those fed cottonseed hulls and corn stover. This was produced at a saving of \$11.42 in cost of feed.

A progress report is made of four years' work at Pender substation and near Greensboro in cooperation with farmers to test the value of a limited ration of cottonseed meal for wintering growing dairy calves. Each year one lot of calves was fed a grain ration of cottonseed meal alone and another lot a grain ration of cottonseed meal and bran (1:1). The roughage was the same for both lots. Summarizing the four years' work, during which the calves were upon experimental feeds for 553 days, it was found that the respective feed

costs were \$99.33 and \$98.88, while the calves fed no bran gained an average of 148 lbs. more per head. At Pender the same feeds were also compared as supplements for scant pasture for dairy heifers during the spring and summer. During the three summers this experiment has been running the calves fed cottonseed meal have made the better gains, but this ration was somewhat the more expensive.

Data on the cost of raising 22 calves at Pender show that when these calves were 6, 12, and 18 months old they averaged per head 264, 373, and 478 lbs. in weight, respectively, at total costs of \$13.57, \$26.12, and \$34.30. Four of the calves which attained the age of 30 months averaged 646 lbs. in weight at a total cost of \$52.06. These figures include market prices for feeds and \$1 per month each for pasture, no credit being made for manure. Cooperative experiments with farmers in Guilford and Forsyth Counties show a cost of \$31.58 to raise a dairy calf to the age of 12 months.

A study is being made at Pender relative to the feasibility of overcoming onion flavors in milk. In one case a strong onion flavor was found in the milk of a cow milked 19 hours after the onions had been eaten. It has been found that molasses fed in conjunction with other feeds materially weakens the onion flavor, but does not remove it completely. Other remedies being tried are charcoal, soda, mixtures of charcoal, soda and molasses, and patent preparations. These have been without effect, except that one of the patent preparations has caused some weakening of the onion flavor.

(Feeding experiments with dairy cattle), J. M. SCOTT (*Florida Sta. Rpt. 1915*, pp. 13-23).—In a comparison of sorghum silage and Japanese cane silage as supplements for wheat bran and cottonseed meal for dairy cows, ten cows were fed during four periods of 16 days each with four days between experimental periods for changing feeds. The cows were fed in lots of five by the reversal system. Those on sorghum silage produced 589.72 gal. of milk at a feed cost of 12.1 cts. per gallon and those on Japanese cane silage 509.74 gal. of milk at a feed cost of 12.8 cts. per gallon. In this experiment the silage was valued at \$4 per ton. All the cows gained slightly in weight during the test, there being no difference between the two rations in maintaining the animal's initial weight.

A comparison was also made of sorghum silage and sweet-potato silage as supplements for wheat bran and cottonseed meal. In this test ten cows were fed by the reversal system during two periods of 20 days each with three days for change of feeds. The five cows on sorghum silage produced 280.9 gal. of milk at a feed cost of 14.8 cts. per gallon. The five cows fed sweet potato silage produced 307.1 gal. of milk at a feed cost of 15.4 cts. per gallon. In this experiment sorghum silage was valued at \$4 and sweet-potato silage at \$13 per ton. Each of the cows gained in weight during the test. This work has shown that it is practicable to preserve sweet potatoes in the silo for cattle feeding and for feeding purposes.

During the winter of 1915-16 sorghum silage and Japanese cane silage were compared for feeding young cattle. Grade Jersey heifers from 15 to 20 months old were fed for 60 days all the silage they would eat and 1 lb. of cottonseed meal each daily. The animals fed sorghum silage gained an average of 8.25 lbs. each during the 60 days, and those fed Japanese cane silage barely maintained their weights.

Feed and care of the dairy calf, R. S. HULCE and W. B. NEVENS (*Illinois Sta. Circ. 202* (1917), pp. 13, figs. 6).—Methods of feeding and care are given which have been found by experience to give good results in the rearing of calves.

The average weights at one day of age of calves born in the university herd are classified according to breed and sex as follows, the first figure under each breed being for females and the second for males: Jersey 59.7 and 62.4, Guernsey 68.8 and 70, Ayrshire 71.4 and 77.7, and Holstein 88 and 90 lbs. At the station a group of 20 Holstein heifers from birth to one year of age consumed 244 lbs. of whole milk, 890 lbs. of skim milk, 1,107 lbs. of grain, 1,967 lbs. of hay, and 1,620 lbs. of silage per head. These heifers averaged 12 lbs. at birth and 532 lbs. at one year and made an average daily gain of 1.2 lbs.

Selecting rations for dairy cows, G. C. WHITE and K. B. MUSSER (*Connecticut Storrs Sta. Bul. 50 (1917), pp. 3-33*).--The requirements to be considered in formulating dairy rations are discussed and tables are given showing the characteristics of some common feeds; the nutrients required by dairy cows for maintenance and milk production; the digestible nutrients, fertilizing constituents, and value of feeding stuffs; the average wholesale prices for 13 years of feeding stuffs in carload lots at Boston points; high and low prices of some common feeds by months for five years; cost per hundredweight of digestible nutrients at different prices for feeds, etc. Full directions are given for selecting and compounding rations, and suggestions are offered for analyzing the feed market.

Dairy feeding and the calculation of rations, L. S. RUFORD (*New Jersey Stas. Circ. 73 (1917), pp. 15*).--This circular explains briefly some common feeding terms, gives directions for the use of the feeding standard, and offers suggestions for the purchase of concentrates and the use of home-grown feeds.

Dairy herd [record], J. M. SCOTT (*Florida Sta. Rpt. 1916, pp. 14-17, figs. 3*).--Tables show the milking record, age and breed of cows, time in milk, milk and fat production records, and cost data of the station dairy herd during the fiscal year. Of 19 pure-bred and grade Jerseys being milked during the year, the highest yield was 5,907.7 lbs. of milk and 300.75 lbs. of fat. The cost of feed for this cow was \$94.86. Valuing butter at 40 cts. per pound and milk at 32 cts. per gallon, she returned a profit of \$124.95 over cost of feed.

Germ content of milk.--I. As influenced by the factors at the barn, M. J. PRUCHA and H. M. WEEVER (*Illinois Sta. Bul. 192 (1917), pp. 25-51, figs. 3*).--The investigation here reported is a part of that begun by Harding et al. (*E. S. R.*, 29, p. 878). Its purpose was to measure the collective influence of all the barn conditions and operations upon the germ content of the milk produced therein. The data were obtained in three dairy barns during the years 1914 and 1915. A description is given together with an illustration of the interior of each of the barns. The three barns "in a general way represent three classes of dairy barns, barn 1 being in excellent condition, barn 2 being good, and barn 3 poor. The difference between barns 1 and 2 as to cleanliness, however, was not very great. On the other hand, barn 3 would be classed as a dirty barn."

The utensils used were thoroughly steamed before each milking. In 1914 the udders of all the cows were wiped with a damp cloth previous to each milking, but in 1915 this practice was discontinued. All samples were taken from the milk of the individual cows when the milker brought it in pails from the barn into the adjacent milk room. The bacteriological examination of the milk was made by the plate method. In order to ascertain the extent of variation in bacterial count due to the laboratory methods employed, ten experiments were undertaken in each of which 100 plates were seeded with the same milk. None of the individual counts varied much more than 25 per cent from the average.

A total of 1,665 samples were taken from 158 cows. Data from the analyses of these samples are tabulated. Among the samples from barn 1 the lowest

germ content was 17 and the highest was 218,250 bacteria per cubic centimeter of milk; in barn 2 the lowest was 3 and the highest was 33,000; and in barn 3 the lowest was 307 and the highest was 63,835. "These are wide limits of variation in the germ content of milk produced under uniform barn conditions."

The following table shows the grouping of all milk samples according to germ content and the average germ content of the milk from the three barns:

Arrangement of milk samples according to germ content and average number of bacteria per cubic centimeter.

Barn.	Below 1,000 per cubic centi- meter.	Between 1,000 and 5,000 per cubic cen- timeter.	Between 5,000 and 10,000 per cubic cen- timeter.	Between 10,000 and 50,000 per cubic cen- timeter.	Over 50,000 per cubic centi- meter.	Average germ content per cubic centimeter of milk.	
						1914.	1915.
1.....	472	297	56	23	6	2,140	3,290
2.....	405	153	4	5	0	973	830
3.....	19	127	57	34	1	6,189	5,059
Total.....	896	577	117	68	7	2,188 (Av.)	2,552 (Av.)

Most of the samples of high germ content in barn 1 came from a few animals. One of these animals persistently gave milk with high germ content and subsequent studies showed that her udder was the source of these large numbers of bacteria in her milk. Data are tabulated showing the average content of the milk of each animal for each of the two years. Of the 72 averages in barn 1, 30 were below 1,000 bacteria per cubic centimeter of milk, 23 were between 1,000 and 5,000, only 7 were over 5,000, and of these 7 only 2 were over 10,000. In barn 2, 30 of the 47 averages were below 1,000, and the highest average was only 3,509. In barn 3 all the averages were above 1,000 bacteria per cubic centimeter of milk, 11 were below 5,000, 6 were between 5,000 and 10,000 and 2 were over 10,000.

It is thus seen that in the production of milk of low germ content the udder of some cows may become the principal source of contamination. It is stated that "no conclusion can be drawn from the data concerning the relative importance of the practice of wiping the udders, as compared with the other sources of contamination in these barns. The data, however, do point to the conclusion that the wiping of the udders under the conditions obtaining in these barns did not affect the germ content of the milk to any appreciable extent."

Commenting on the results of this investigation, the authors state that it might be argued from the results obtained in barns 1 and 2 "that a dirty barn does not contribute more bacteria to the milk than a clean barn. Such conclusion, however, would be against a well-established fact. This apparent discrepancy is only a side issue to the general problem, and it would be a mere conjecture to attempt to explain it. The real significance of the results from these two barns lies in the fact that the number of bacteria in the milk from both barns was remarkably small, and that the difference in the conditions and the operations in the two barns exerted practically negligible influence upon the germ content of the milk.

"Even more significant are the results from barn 3. The average contamination here was 5,777 bacteria per cubic centimeter. This milk, so far as the germ content was concerned, would meet the requirements for certified milk, and yet the conditions of the barn as to cleanliness were such that it is doubtful whether the milk produced here would have been admitted to the milk supply of some cities. These results must not be construed as a defense of

dirty barns. They simply point to the fact that the large numbers of bacteria commonly found in milk do not have their origin in the barn."

Fishiness in evaporated milk. B. W. HAMMEX (*Iowa Sta. Research Bul.* 38 (1917), pp. 235-246, fig. 1).—The author briefly reviews recent literature pertaining to fishy flavor in milk and butter and reports results of a study of the cause of the very fishy odor and flavor that had developed in one can of evaporated milk. From this can an organism was isolated that was capable of producing fishiness in milk, cream, or evaporated milk into which it was inoculated. In inoculated milk there was, in addition to the development of a fishy odor, a coagulation and a rapid digestion. The isolated organism when inoculated into butter, either directly or into sweet or sour cream either pasteurized or sterilized before churning, failed to produce fishiness. In some lots of butter, salt was used while other lots were unsalted. The counts made showed that the numbers of bacteria per gram decreased throughout the holding period with butter made from sour cream and with salted butter made from sweet cream, while with unsalted butter made from sweet cream there was an increase which was followed by a decrease.

A description is given of the organism under the name *Bacillus ichthyosmius*, apparently a new species closely related to the *Proteus* group. It is suggested that the organism, which fails to resist heat, may have gained entrance to this can after heating, probably through some hole in the metal which was sealed shortly after sterilization.

The manufacture of cottage cheese in creameries and milk plants (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub.], (1917), pp. 4*).—This circular points out the advantages of pasteurizing skim milk for the purpose of controlling the flavor of cottage cheese, describes in brief the methods of manufacture, packing, and marketing, and gives an estimate of the yield of cottage cheese to be expected from skim milk.

Simple directions for making cottage cheese on the farm (*U. S. Dept. Agr., Bur. Anim. Indus. [Pub.], (1917), pp. 3*).—Brief directions are given for the utilization of skim milk for making cottage cheese on farms.

A substitute for litmus for use in milk cultures. W. M. CLARK and H. A. LUNS (*U. S. Dept. Agr., Jour. Agr. Research*, 10 (1917), No. 3, pp. 105-111).

"The color changes which occur in litmus-milk cultures may be due to changes in the hydrogen-ion concentration of the medium, or to reduction, or even destruction of the dye. If it is the degree of acid or alkali fermentation which is sought, it is advisable to use an indicator which will not be affected except by a change in the hydrogen-ion concentration." Dibromooorthocresolsulfonaphthalein, for which the short name bromocresol purple is suggested, is said to fulfill this condition. The authors have described the preparation of this compound (*E. S. R.*, 36, p. 111) and have suggested its use in the determination of hydrogen-ion concentration (*E. S. R.*, 37, p. 506.) For ordinary indicator purposes a 0.04 per cent aqueous solution of the monosodium salt is recommended, but as a stock solution for the present purpose a solution of the salt containing 0.5 per cent of the acid is suggested. A method is given for the preparation of this solution.

In comparing litmus and bromocresol purple as indicators in milk cultures it is stated that "litmus undergoes a temporary reduction during sterilization in the presence of milk. Bromocresol purple does not. The coloring power of litmus is relatively weak; bromocresol purple in very high dilution is useful. Litmus and azollitmin are indicators of uncertain composition; bromocresol purple is a definite individual compound obtainable in crystalline form and therefore reproducible. Its cost is not excessive.

The impurities of litmus preparations vary in their effect upon the P_H of milk and often necessitate elaborate adjustment either of the litmus solution, of the milk, or of the mixture if reproducible color is to be obtained. Bromocresol purple, on the other hand, may be used with the assurance that, if other conditions are constant, it will always produce the same coloration. Some of the difficulty experienced in reproducing a particular initial color with either indicator is shown to be due to the changes in P_H which occur when milk is sterilized by heat.

The comparative value of litmus and bromocresol purple in milk cultures was tested with a variety of organisms. It was found that no change in reaction could be observed with litmus which could not be followed equally well with bromocresol purple. In many instances litmus was rendered useless by reduction or destruction while bromocresol purple continued to act as a true indicator of the hydrogen-ion concentration."

VETERINARY MEDICINE.

Annual reports of the State veterinarian of Alabama, 1914 and 1915, C. A. CARY (*Ann. Rpt. State Vet. Ala.*, 8 (1914), pp. 28; 9 (1915), pp. 48).—These reports, dealing with the work of the years 1914 and 1915 respectively, include accounts of the occurrence of and control work with diseases of live stock, including tick eradication.

Report of the Montana Live Stock Sanitary Board and State veterinary surgeon for years 1915–16 (*[Bism.] Rpt. Mont. Live Stock Sanit. Bd., 1915–16, pp. 59, pl. 1*).—This report, dealing with the work of the year with infectious and other diseases of live stock, includes a discussion of tuberculosis free accredited herds, contagious abortion, etc., and gives a list of official dips and disinfectants, live stock sanitary board orders, regulations governing importation of live stock into Montana, etc. A short popular article on cattle lice in Montana, by R. A. Cooley and R. R. Parker, is included.

Diseases of domestic animals (*Rpt. Dept. Agr. [N. H.], 34 (1915–16), pp. 55–99*).—This reports upon the occurrence of and control work with infectious diseases of live stock in New Hampshire.

Annual reports of the chief veterinary officer for the years 1914 and 1915, S. STOCKMAN (*Bd. Agr. and Fisheries [London], Ann. Rpt. Chief Vet. Off., 1914, pp. 62; 1915, pp. 12*).—These report briefly upon the occurrence of and work with the more important diseases of animals during 1914 and 1915.

In the report for 1914 some cross-immunization tests with *Piroplasma bigeminum* and *P. divergens* are noted which indicate that animals immunized against *P. bigeminum* are not protected against infection by *P. divergens*, or vice versa.

For obtaining massive cultures of *Bacillus abortus* a medium prepared as follows was used: Five hundred gm. of raw potato in small pieces is macerated in 2000 cc. of water, placed in an incubator for 12 hours at 60° C. and then strained through a flannel bag. To the filtrate, 10 gm. of meat extract, 10 gm. of salt, and 20 gm. of Witte's peptone are added. The mixture is steamed for 1 hour, strained through a flannel bag, rendered slightly alkaline, and again steamed for 1.5 hours. A slight precipitate results which is removed by filtration through paper. The filtrate is finally sterilized in the autoclave and kept as a stock solution. With the addition of 1 per cent of sugar and 1 per cent of glycerin the material constitutes an excellent liquid medium for cultivating the organism.

For making a solid medium, 60 gm. of agar is added to 2,000 cc. of the stock solution and melted in the usual way. After clarifying by the usual method,

the medium is again neutralized, if necessary, and grape sugar and glycerin added as for the liquid medium. The material is then sterilized in the autoclave, either in bulk or in culture flasks.

Immunity in its relation to the stock diseases of Southern Rhodesia, I. E. W. BRYAN (*Rhodesia Agr. Jour.*, 13 (1916), Nos. 5, pp. 640-651; 6, pp. 800-812, pls. 2; 14 (1917), No. 2, pp. 215-234, pls. 2).—This is a general review of the subject with special reference to the stock diseases of Southern Rhodesia.

Anaphylatoxin and anaphylaxis, F. G. NOVY and P. H. DEKRUIF (*Jour. Amer. Med. Assoc.*, 68 (1917), No. 21, pp. 1524-1528).—This is a general summary of the studies previously noted (E. S. R., 37, p. 578).

The effect of temperature on the rate of complement fixation, J. BRONFENBRENNER and M. J. SCHLESINGER (*Proc. Soc. Expt. Biol. and Med.*, 14 (1917), No. 7, pp. 132, 140).—The authors have studied the relation between the temperature and the rate of fixation and have found that "if sufficient antibody is present in the serum (three to five units or more) fixation of two units of complement takes place within the first five minutes, provided the amount of antigen used contains several antigenic units. We find it possible to use this procedure for presumptive elimination of strongly positive sera from a large series of cases. One places in a tube 0.05 cc. of the patient's serum, adds the proper amount of antigen and salt solution and incubates at 37° C. in the water bath for five minutes, and then adds sensitized cells to test for free complement. Where a rapid fixation of complement is desired a temperature of 37° is indicated as being the best. One-half hour of incubation at this temperature is considered to be the most efficient for diagnosis.

Where the time element is of little importance, but complete fixation is desired, incubation in the ice box for from eight to ten hours is found to be the best. "These fixations on ice, however, may not be specific, for the reaction of fixation is so complete under these conditions that even traces of secondary circulating antigens and their corresponding antibodies may cause fixation of complement. The ice-box fixation can, therefore, be used only as a presumptive test to eliminate the negative cases."

For the fixation of complement at temperatures below the freezing point such a procedure was found to produce undesirable changes in the reagents, especially in the antigen, and was therefore unsuitable for the test.

The specific serum treatment of wounds, E. LECCLAICHE and H. VALLÉE (*Jour. Compar. Path. and Ther.*, 29 (1916), No. 4, pp. 283-290).—This is an English translation of the material previously noted (E. S. R., 35, p. 882).

Plants poisonous to live stock, H. C. LONG (*Cambridge: University Press*, 1917, pp. VII+119, pl. 1).—A brief summary of the present knowledge of plants poisonous to live stock in Great Britain, with symptoms, toxic principles, and a list of the more important references to the bibliography in relation to each plant. The poisonous plants are dealt with under their respective orders, and accounts are given of plants suspected of being poisonous, the effects of plants on milk, plants which cause mechanical injury, and the classification of poisons. A bibliography of 267 titles is appended and a subject index included.

Potassium permanganate as an antidote for the effects of poisonous plants, C. D. MARSH (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 3, pp. 419, 420).—The author calls attention to the fact that for practical purposes the use of a drench of potassium permanganate in the case of ruminants poisoned by plants is without value, as previously shown (E. S. R., 35, p. 779). While potassium permanganate, tannic acid, or sodium bicarbonate would be logical antidotes for alkyloloidal poisonings, they are effective only as they come into actual contact with the poisonous substances. It has been found experimentally that if the antidote is given repeatedly at intervals of 30 minutes or less

it is effective, for it then attacks the poisonous substance as it passes through the abomasum.

Studies in forage poisoning, IV, R. GRAHAM and L. R. HIMMELFELDER (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 2, pp. 164-187, figs. 6).—This report is based upon investigations conducted at the Kentucky Experiment Station and previously noted (E. S. R., 36, p. 581).

During the course of investigations in connection with a definite outbreak of forage poisoning various types of microorganisms that proved to be quite uniformly poisonous to horses and mules were isolated from oat hay. Among these was a spore-forming, Gram negative, aerobic bacillus which was pathogenic for horses and mules and less so for cattle, sheep, and goats, but to which guinea pigs, rabbits, and white mice were apparently immune. Sterile filtrates of this bacillus subsequent to daily intravenous injections in some experimental horses proved pathogenic and capable of exciting clinical manifestations somewhat analogous to affected animals in the original outbreak as the result of feeding on oat hay.

The bacillus previously noted (E. S. R., 36, p. 581) was isolated from silage in a remote outbreak of forage poisoning among cattle.

Cottonseed meal work, W. A. WITHERS (*North Carolina Sta. Rpt.* 1916, pp. 19, 20).—This is a brief review of investigations during the year of the toxicity of cottonseed meal which have confirmed the views previously presented (E. S. R., 34, p. 381) that gossypol is the toxic substance of cottonseed.

Blackleg filtrate, A. EICHORN (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 3, pp. 406-415; *Amer. Jour. Vet. Med.*, 12 (1917), No. 6, pp. 375-378).—The biological products proposed and used in blackleg are briefly reviewed. Preparation of a filtrate from media containing meat upon which the organism was grown until no more gas was produced, together with a procedure for its standardization, is noted.

The filtrate is considered to be an effective immunizing agent, conferring an active immunity which protects cattle against blackleg for as long a time as the germ-free extracts prepared from the juices of the tissues of affected animals. The losses incidental to vaccination with the powder or pellets are entirely avoided, since the preparation does not contain the blackleg germ.

The material in a concentrated form was found to retain its potency for almost an indefinite time. The necessity of the usual sterility tests of the filtrate, in order to guard against possible contamination, is indicated.

The virulence of the blood of animals affected with foot-and-mouth disease and immunity tests, G. COSCO and A. AGUZZI (*Gior. Med. Vet.*, 66 (1917), No. 14, pp. 313-320).—This is a brief report of the investigation ordered by the Italian minister of the interior in 1916. The topics treated are incubation, fever, time of maximum virulence of blood, virulence of red blood corpuscles, minimum dose of blood, increase of virulence of red blood corpuscles, temporary infection through the mouth, intravenous injection, and immunity tests.

Allergic reaction of mallein for the diagnosis of glanders, E. FAVA (*Arch. Sci. Med. Vet. [Turin]*, 14 (1916), No. 1-12, pp. 1-131, figs. 27).—The author describes and submits experimental data obtained through the application of the subcutaneous, ophthalmic, and intrapalpebral mallein tests, and discusses the specificity of the intrapalpebral reaction and its advantages over the other methods of malleinization, the intrapalpebral test for the prophylaxis of glanders, and its application.

It is concluded in general that the intrapalpebral test possesses advantages over the other procedures for the diagnosis of glanders, the advantages being those essentially noted by other investigators.

Milk sickness, D. T. GRAY (*North Carolina Sta. Rpt. 1916, p. 36*).—A brief statement of work by Curtis and Wolf (*E. S. R., 37, p. 583*).

Studies on the paratyphoid-enteritidis group.—III, Some cultural characteristics and their relation to host origin, C. KRUMWIEDE, JR., JOSEPHINE S. PRATT, and L. A. KOHN (*Jour. Med. Research, 35 (1917), No. 3, pp. 357-366*).—"The quantitative differences in the reduction of fuchsin, added to the fermentative results, especially of dulcitol and arabinose, give fairly defined groups. This grouping is only suggestive in that it correlates to some extent with host origin, a correlation hitherto not observed. It also correlates with the primary or secondary invasive properties of the various types. As would be expected, the latter are much more heterogeneous.

"Some of the results do not correlate with agglutinative results and suggest the necessity of further study in relation to such correlation."

Studies on the paratyphoid-enteritidis group.—IV, The differentiation of the members of the paratyphoid-enteritidis group from *B. typhosus* with special reference to anaerogenic strains and observations on the fermentative characteristics of the avian types, C. KRUMWIEDE, JR., and L. A. KOHN (*Jour. Med. Research, 36 (1917), No. 3, pp. 509-518*).—"The ability to produce acid from rhamnose is the essential characteristic of the paratyphoid-enteritidis group, differentiating both the aerogenic and anaerogenic members from *B. typhosus*. Additional cultural differences between *B. typhosus*, *B. sanguinarum*, and *B. pullorum* are presented. The agglutinative relationship of the strains studied is recorded. Observations are added on the low or latent avidity for carbohydrates in relation to variability and practical differentiation. Without due regard to these factors, erroneous differential significance might easily be given to variation even among members of the fixed groups."

Effect of the injection of nonspecific foreign substances on the course of experimental rabies, W. H. BURMEISTER (*Jour. Infect. Diseases, 21 (1917), No. 1, pp. 95-107*).—"The injection of certain nonspecific substances (horse serum, serum globulin, egg white, egg yolk, broth, typhoid vaccine, or tuberculin) does not inhibit the course of experimental rabies in rabbits produced by nonattenuated virus. The seemingly beneficial effect of tuberculin in the early series of the experiments must be disregarded because of the survival of some control animals inoculated at a later date with the same virus. . . . Rabbits surviving an intracerebral inoculation of attenuated rabies virus (fixed or street virus) may become hypersensitive to a reinoculation of the same virus made in the same way."

Tuberculosis in camels, F. E. MASON (*Jour. Compar. Path. and Ther., 30 (1917), No. 1, pp. 80-84*).—The literature on the occurrence of tuberculosis in camels is briefly reviewed. Continuing the work previously noted (*E. S. R., 29, p. 676*), the author has examined and made bacteriological studies of a large number of camels slaughtered in the Cairo abattoir. The disease appears to occur chiefly in Egyptian camels and the causative organism to be of the bovine type.

The source, method of infection, course, distribution of lesions, and histology of lesions of tuberculosis in the camel are briefly discussed.

The subcutaneous tuberculin test with ordinary tuberculin was successfully employed on infected animals. Data relative to the variations in the normal temperature of camels are submitted.

Brisket disease, G. H. GLOVER and I. E. NEWSOM (*Colorado Sta. Bul. 229 (1917), pp. 3-8, figs. 3*).—This is a revised and abbreviated edition of Bulletin 204, previously noted (*E. S. R., 32, p. 781*).

Report of the division of veterinary science, G. A. ROBERTS (*North Carolina Sta. Rpt. 1916, pp. 55-57*).—The principal work of the year was with conta-

gious abortion, some 2,500 cows and heifers in 70 herds at 35 different points in the State being examined. In agglutination and complement fixation tests of 203 samples of blood from cattle in various sections of the State 65 per cent gave positive reactions with one test or the other, 17 per cent negative reactions to both tests, and 18 per cent suspicious reactions.

Keratitis infectiosa in cattle (*Keratitis pyobacillosa*), J. PORIA, trans. by J. KAPPEYNEY and A. R. WARD (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 4, pp. 526-531).—The author's investigations have led to the conclusion that *Bacillus pyogenes* is the specific cause of the infectious eye disease of cattle now existing in Holland, and that the two species of micrococci found present are secondary invaders. The author has used pyogenes serum as a prophylactic and as a curative agent with favorable results.

The life history of *Hypoderma bovis* and *H. lineatum*, S. HADWEN (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 4, pp. 541-544).—The observations here reported are based upon work at Agassiz, B. C. The principal differences between the two warble flies, both anatomically and biologically, are pointed out. It is thought that with *H. lineatum* several larvæ enter through the same opening in the skin.

Feeding lambs in the summer to prevent stomach worms, D. T. GRAY (*North Carolina Sta. Rpt. 1916*, p. 35).—A first year's feeding experiment which was carried on to determine whether a heavy grain ration had any effect in overcoming the ravages of the stomach worm, in which 30 lambs were used, indicates "strongly that there is a very definite relationship between deaths by stomach worms and grain fed through the pasture season."

Hog cholera transmission through infected pork, R. R. BIRCH (*Jour. Amer. Vet. Med. Assoc.*, 51 (1917), No. 3, pp. 303-330, figs. 3).—Detailed experimental data of a study on the effects of feeding susceptible pigs bits of pork such as might be found in garbage are reported in tabular and graphical form and discussed.

It was found that the meat and bone taken from carcasses of hogs killed before any manifestation of hog cholera other than elevation of temperature, at a time when they will pass inspection, will usually produce the disease when fed in small quantities to susceptible pigs. In hog-cholera infected carcasses that passed inspection the virus was not often killed in parts sold as fresh or refrigerated products. In sugar-cured hams the virus was killed in 12 out of 21 experimental cases.

"Measures to prevent hog-cholera infections due to feeding trimmings from market pork should include efforts to prevent marketing infected herds, efforts to prevent the sale of carcasses in products in which the virus is not killed, and efforts to acquaint swine breeders with the danger incident to feeding kitchen refuse. Farmers can avoid the danger mentioned by discontinuing the feeding of kitchen refuse, by placing all pork trimmings elsewhere than in the garbage pail, by thoroughly cooking all garbage before it is fed, or by immunizing their hogs. Men who collect and feed city garbage can avoid the danger by cooking all the material they feed or by immunizing their hogs."

The importance of severe interpretation of temperatures, symptoms, and lesions observed during inspection to indicate the proper treatment of any animals that might be infected without condemnation of appreciable numbers is indicated.

Transmission of piroplasmosis to three pigs by ingestion, SPARAPANI (*Pathologica*, 9 (1917), No. 196, pp. 21, 22; *abs. in Trop. Vet. Bul.*, 5 (1917), No. 2, p. 90).—The author reports upon infection in pigs apparently brought about by ingestion of the flesh of infected sheep.

A note on dourine in the horse, H. T. PEASE (*Agr. Jour. India*, 12 (1917), No. 2, pp. 250-251, pls. 5, fig. 1).—A discussion of the disease and its treatment.

Abortive treatment of equine filariasis by the hypodermic injection of a permanganate of potassium solution, MONNET (*Rev. Gén. Méd. Vét.*, 22 (1913), No. 262, pp. 534-537; *abs. in Vet. Rec.*, 27 (1915), No. 1594, p. 498).—The subcutaneous injection of 10 cc. of a 1 per cent solution of permanganate of potassium at six points in the pericentricul zone has resulted in the cure of summer sores. The author is of the opinion that this treatment will give good results and that it may also be employed in filariasis of the tendons.

[Epizootic lymphangitis in France] (*Bul. Soc. Cent. Méd. Vét.*, 92 (1916), Nos. 8, pp. 156-152, pl. 1; 11-12, pp. 144-155, pls. 4; 22, pp. 334-346; 24, pp. 385-388, 402-404; 93 (1917), Nos. 3-4, pp. 64-68; 6, pp. 99-109; 9-10, pp. 191-204; *Rec. Méd. Vét.*, 92 (1916), No. 21, pp. 614-618; 93 (1917), No. 7-8, pp. 179-196, figs. 5).—Epizootic lymphangitis, a disease rarely seen in France before the war, has since been introduced with horses imported from northern Africa and is of quite frequent occurrence.

Several papers relating to the disease are presented as follows: Epizootic Lymphangitis in France: Diagnosis and Treatment, by J. Bridré; Treatment of Epizootic Lymphangitis—Trials with Galyl (Tetraoxydiphosphaminodiarso-benzene), by Douville; Treatment of Epizootic Lymphangitis by Novarsenobenzol, by Velu; Note on the Treatment of Epizootic Lymphangitis by Potassium Iodid, by J. Cartier (*E. S. R.*, 37, p. 377); Epizootic Lymphangitis in France—Its Treatment by the Chatelein Method and Its Prophylaxis, by E. Nicolas; Epizootic Lymphangitis in the Region of Mekhez, by Aubry; Epizootic Lymphangitis, by Velu; Observations Relative to the Incubation of Epizootic Lymphangitis, by H. Chapron; Contribution to the Study of Epizootic Lymphangitis, by Truche and Guignard; Epizootic Lymphangitis—Symptomatology, by Velu; Apropos of Epizootic Lymphangitis and Its Treatment, by Fayet; Epizootic Lymphangitis, by Charmoy; Notes on the Determination of the Incubation Period of Epizootic Lymphangitis in France, by Perrin; and The Curative Treatment of Epizootic Lymphangitis by Vaccine Therapy, by Velu.

Epizootic lymphangitis in France: Its diagnosis and treatment, J. BRIDRE (*Vet. Jour.*, 73 (1917), No. 503, pp. 173-175).—This is a review of the article by Bridré above noted.

The author, together with Negri and Trouette, has obtained excellent results from the intravenous injection of arsenobenzol, but novarsenobenzol is deemed much more convenient to use and quite as effective. He recommends a dose of from 2 to 3 gm. in 20 cc. of distilled water, the injection to be made in the jugular vein.

"Stomatitis contagiosa" in horses, A. C. BURTON (*Vet. Jour.*, 73 (1917), No. 505, pp. 234-242, figs. 4).—The author has found that this disease of the horse is transmissible to man, both he and two assistants having contracted it. The disease in man was of short duration and mild, but very painful. The incubation period appeared to be from one to three days. Any immunity conferred by an attack appears to be short, reinfection having apparently taken place in less than two months.

The author has found frequent irrigation and cleansing of the mouth with potassium permanganate (0.5 oz. to 5 gal. of water) by means of a Vermorel sprayer carried on the back, the nozzle covered with a piece of rubber hose pipe, to be a very satisfactory means of treatment for army horses.

Note on an outbreak of contagious pneumonia in donkeys, R. BEANFORD (*Agr. Jour. India*, 12 (1917), No. 2, pp. 268-273, pls. 2).—This reports upon an outbreak of this disease among the young stock donkey jacks at the Government Cattle Farm, Hissar, on July 20, 1916.

Another cestode from the young cat, J. E. ACKERT and A. A. GRANT (*Trans. Amer. Micros. Soc.*, 36 (1917), No. 2, pp. 93-96).—The authors find that the dog tapeworm (*Tania pisiformis*) may develop in the young cat (*Felis domestica*) and that evagination of *Cysticercus pisiformis* occurs in the duodenum of the domestic kitten.

Some of the infectious diseases of poultry, E. M. PICKENS (*Cornell Vet.*, 7 (1917), No. 3, pp. 151-184).—A systematic summary of information on the more important infectious diseases of poultry.

RURAL ENGINEERING.

Flow through sharp-edged V-notches or weirs, E. W. DOBBLES and F. H. RAYFIELD (*Cornell Civ. Engin.*, 25 (1917), No. 8, pp. 389-397, figs. 7).—Experiments are reported on the flow of water through V-notch weirs to determine the experimental coefficient μ in the formula

$$Q = \mu 8/15 \tan 1/2\alpha 2 gh^{3/2}$$

for heads higher than those used in previous experiments by others. Four notches were studied. The smallest had the Cippoletti side slopes of one horizontal to four vertical, an angle of approximately 28°. The other three angles were 60, 90, and 120°. Heads were used up to 3 ft.

It was found that "the 60° notch has the lowest average coefficient, about 0.578, with the value for the 90° a very little higher, about 0.58. The average values of μ for the 28 and 120° notches are respectively about 0.59 and 0.591, or about 2 per cent higher than the values for the intermediate notches. These averages are for the medium heads. . . . For all of the notches there is a rapid increase in the value of the coefficient at the high heads. This increase is, no doubt, partly due to the velocity in the channel of approach. . . .

"For those runs for which the velocity measurements were made, the mean heads were increased by their respective velocity heads and another coefficient computed. Considering these coefficients, there is still a marked increase in the value of the coefficients which tends to show that it is not entirely due to velocity. The nearness of the edges of a notch to the sides of the channel has an effect upon the coefficient."

Spray irrigation, G. H. TOLLEY (*Water Conserv. and Irrig. Com., N. S. Wales, Bul. 1* (1917), pp. 32, figs. 36).—This pamphlet discusses the general principles of spray irrigation, and describes service tests of several different systems of spray irrigation.

Irrigation laws of the State of Washington, compiled by I. M. HOWELL (*Olympia, Wash.: State, 1916, 2. ed., pp. 173*).—The text of the laws is given.

Irrigation revenue report of the Bombay Presidency, excluding Sind, 1914-15 (*Irrig. Rev. Rpt. Bombay Pres., 1914-15, pp. 49*).—Data on expenditures and revenues for irrigation works in Bombay for the year 1914-15 are reported.

Annual report, Ministry of Public Works, Egypt, 1915-16, M. MacDONALD (*Ann. Rpt. Min. Pub. Works Egypt, 1915-16, pp. 87, pls. 9*).—A large part of this report is devoted to drainage and irrigation projects in Egypt, especially as they are affected by the European war.

[Water analyses] (*An. Min. Agr. Argentina, Secc. Geol., Mineral. y Min.*, 11 (1916), No. 4, pp. 53-63).—Analyses of 13 samples of 8 water supplies from 5 Provinces in Argentina showed 7 of the supplies to be potable. Analyses of 102 samples of 35 water supplies of 12 Provinces showed 19 samples potable.

Reaeration as a factor in the self-purification of streams, E. B. PHILLIPS (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 4, pp. 403-405).—It is pointed out, on the basis of work by the U. S. Public Health Service, that "in the development of the maximum economic use of a stream, its capacity to dispose of

sewage and waste within any specified degree of depreciation or nuisance is a factor of first importance. This capacity is limited by stream conditions and is a function of the capacity for re-aeration. For this reason the dilution unit is an improper one for a discussion of nuisance and self-purification, and results obtained upon one stream, expressed in such units, are not applicable to another. Re-aeration is capable of experimental determination not only in single instances but in terms of general applicability. Its determination in such general terms involves laborious work of a hydraulic and analytical nature."

The javellization of water in the field, E. ARNET (*Rev. Hyg. et Pol. Sanit.*, 52 (1917), No. 2, pp. 98-104, figs. 3).—This process is described.

A comparison of the activated sludge and the Imhoff tank trickling filter processes of sewage treatment, H. P. EDDY (*Jour. West. Soc. Engin.*, 21 (1916), No. 10, pp. 816-852, figs. 11; *Surveyor*, 51 (1917), No. 1317, pp. 370-372, figs. 2).—From a comparison of the two processes of sewage treatment it is concluded that at the present time "the Imhoff tank trickling filter process is a less expensive means of oxidizing the organic matter of sewage wastes than the activated sludge process, where oxidation alone is considered. If the areas of land required for isolation, the loss of head in the plant, the danger of objectionable odors and of the fly annoyance, and other disadvantages of the trickling filter process are of marked importance in any specific case, the balance may be decidedly in favor of the activated sludge process, even in its present state of development. . . . Further attention should be given to improvement in the design and operation of the oldest processes of sewage treatment."

Marked advance in treating sewage from packing houses, G. B. ZIMMEL (*Engin. News-Rec.*, 78 (1917), No. 9, pp. 456, 457, fig. 1).—Experiments conducted at North Worth, Tex., on the treatment of packing-house waste by means of a small activated sludge plant showed that this sewage can be successfully handled by the activated sludge treatment. With reference to the fertilizing value of the sludge it was found that "the addition of the acid holds the ammonia contrary to the effect of adding lime. Second, the availability of the nitrogen is increased. By the neutral permanganate method, blood contains about 90 per cent available nitrogen, but this treated sludge contains about 83.5 per cent available nitrogen."

An experimental test of the relation of sewage disposal to the spread of pellagra, J. F. SILER, P. E. GARRISON, and W. J. MACNEAL (*Arch. Int. Med.*, 19 (1917), No. 5, pt. 1, pp. 683-694, figs. 2).—An account is given of an experiment conducted in a small milling community in South Carolina which had long been a conspicuous endemic center of pellagra. In the fall of 1913 the installation of a water carriage sewerage system was begun and a few houses were equipped with water and fly tight pall closets. As far as possible all privies in the community were made fly and water tight regardless of their character.

"The diminution in new cases of pellagra in this community from 30 in 1913 to 18 in 1914, eight in 1915, and two in 1916 has been very remarkable, and the obvious cause of this improvement would appear to be the intentional experimental factor, namely, the installation of the sewerage system. . . . The installation of sanitary systems of sewage disposal is recommended as a measure for the restriction of the spread of pellagra in the general population."

Rational and economic sanitary treatment of human wastes, F. GARRIGOU (*Compt. Rend. Acad. Sci. [Paris]*, 162 (1916), No. 17, pp. 649-651; *abs. in Chem. Abs.*, 10 (1916), No. 19, p. 2490; *Internat. Inst. Agr. [Rome]*, *Internat. Rev. Sci. and Pract. Agr.*, 7 (1916), No. 7, pp. 947, 948).—A method of sewage treatment considered as an economic war measure in France is described.

The liquid and solid constituents are separated by sedimentation and decantation. The treatment of the liquid portion is based on the double decomposition

of calcium sulphate in the presence of ammonium carbonate, giving calcium carbonate and ammonium sulphate. The calcium carbonate settles out and the liquid containing ammonium sulphate is concentrated until the crystals separate. The precipitated calcium carbonate contains much organic matter rich in nitrogen. The solid matter from the decantation process is filter pressed and then autoclaved for 15 minutes at 140 to 150° C. The vapors from the autoclave are condensed to recover the ammonia salts in them, and the solids remaining in the autoclave are dried for fertilizer. This process, it is stated, requires only a simple apparatus and cheap chemicals and is considered to be adapted for use on farms and in rural communities of France, as well as in larger towns, for the production of fertilizer from sewage.

Rural sanitation (*Cal. Bd. Health Mo. Bul.*, 12 (1916), No. 2, pp. 74-81; *abs. in Chem. Abs.*, 10 (1916), No. 21, p. 2780).—This article outlines the public health methods of the California State Board of Health and describes common unhealthful conditions, including sewage entering streams, contaminated wells and water supplies, carelessness in producing and handling milk, manure piles, fly and mosquito breeding places, and insanitary privies. A form of notice to abate nuisances issued by the board is included.

Fifth annual report of the county highway commissioner of Milwaukee County, Wis., 1916, H. J. KUELLING (*Ann. Rpt. Co. Highway Comr., Milwaukee Co., Wis.*, 5 (1916), pp. 93, figs. 28).—This is a statement of the work and expenditures of the office of the highway commissioner of Milwaukee County, Wis., on highway construction, maintenance, and repair for 1916.

Road problems in the Ozarks, E. G. HARRIS (*Bul. School Mines and Metallurgy, Univ. Missouri*, 9 (1917), No. 1, pp. 23, figs. 6).—This bulletin is a discussion of the road problems encountered in the average sparsely settled, rugged portion of the Ozark uplift, embracing about one-fourth of the area of Missouri. It is stated that in this region the present bad location of many of the roads constitutes the chief reason why improvement is impossible or possible only at great and continuous expense.

A list of references, compiled by H. L. Wheeler, on the construction and maintenance of rural roads is included.

Report of the fourth annual road drag competition, J. KUEHNK and H. W. HERRICK (*Saskatchewan Highway Comrs., Rpt. Road Drag Compet.*, 4 (1916), pp. 22, figs. 8).—An outline is given of the procedure and results of a road dragging competition in the Province of Saskatchewan lasting through the summer of 1916.

Methods of determining the road making qualities of deposits of stone and gravel, L. REINCKE (*Good Roads*, 51 (1917), No. 20, pp. 293-297, figs. 9).—This is an outline of the methods used by the department of mines of Canada in arriving at the relative values of deposits of stone and gravel available for road construction.

"In order to determine the road making values of the rocks in a certain district, they are first divided into formations and then into rock types. Their average values and the variation in strength and cementing value of each type are obtained by laboratory tests on a number of samples, and the results thus obtained are compared with actual service tests in the roads wherever possible. Laboratory studies with the microscope and by chemical analyses are then undertaken to discover the cause of such variations in order to furnish data which will enable the field man to distinguish a good stone from a poor one in the outcrop.

"With a working knowledge of the strength of the bedrock in a district, an attempt is made to devise a classification of the kinds of boulders in the field

stone deposits in such a way that their composition expressed in percentages of durable, intermediate, and soft bowlders will bear a direct relation to their percentage of wear as determined in the laboratory and to their durability under traffic conditions. The pebbles in the gravels of the district are classified in a manner that will bring about the same result. The impurities present and the texture or grading of the gravels are studied in order to furnish advance data as to their probable value in concrete and sheet-asphalt work."

The arrangement of rectangular dairy barns, R. S. HUTCH and W. B. NEVENS (*Illinois Sta. Circ. 139* (1917), pp. 3-30, figs. 23).—This circular enumerates the factors to be considered in the location, lighting, ventilation, and general arrangement of rectangular dairy barns and gives information regarding principles of construction.

Wooden silos used in Nebraska, L. W. CHASE and I. D. WOOD (*Univ. Nebr., Col. Agr. Ext. Bul. 40* (1917), pp. 16, figs. 11).—This bulletin relates especially to the construction of wooden silos under Nebraska conditions and includes diagrammatic illustrations and bills of materials.

The principles of poultry house construction with general and detailed plans, F. C. ELSON (*Canada Expt. Farms Bul. 87* (1916), pp. 55, figs. 55).—This bulletin enumerates the principles of construction and gives general and detailed plans and specifications for farm and commercial poultry houses, including their interior arrangement and equipment.

Better conveniences for rural schools, L. E. SCOTT (*Wis. Farmers' Insts. Bul. 30* (1916), pp. 48-55, figs. 7).—Sanitary conditions and conveniences for rural schools, especially with reference to lighting, heating, ventilation, water supply, and sewage disposal, are discussed.

RURAL ECONOMICS.

The marketing of Kansas butter, T. MACKLIN (*Kansas Sta. Bul. 216* (1917), pp. 3-79, figs. 42).—This investigation was made for the purpose of determining the methods, processes, and costs of marketing butter made both on farms and in creameries of the State.

It is concluded that "dairy farming in Kansas has been and continues to be a side line on the average farm. Experience with whole-milk creameries, local private creameries, and skimming-station centralizers proved that they were not adapted to Kansas conditions, and led to the establishment of cream-station direct-shipper centralizers, which are well adapted to the conditions of Kansas dairy farming. Farm butter making has rapidly declined in Kansas owing to the rapid increase in the efficiency of creameries. . . . The average farmer does not live close enough to favorable markets to make and market butter profitably, except in so far as the stores follow the practice of paying the same price for both good and poor butter. . . .

"Kansas has 78 creameries. Forty-one are centralizers, which make more than 85 per cent of the creamery butter of the State. . . . Centralizers are necessary because there is only one creamery for each 1,053 square miles, and the average farmer lives 19 miles from a creamery. . . .

"The prices paid for delivered butter fat by centralizers averaged above Elgin prices, and according to prevailing economic conditions, appear to be fair. The fact that butter-fat prices in Kansas are somewhat lower than in some other States is because farmers choose to sell four-fifths of their butter fat through cream stations rather than to deliver the cream at their own expense.

"More and better dairy cows would have the effect of reducing the cost of getting butter fat to the creameries, of lowering the cost of making and marketing butter by the creameries, and would result in higher net prices and greater profits to the farmer."

The wheat question, M. PEACHOT (*Vie Agr. et Rurale*, 7 (1917), No. 25, pp. 337-340).—This report discusses the stock of wheat on hand, the consumption requirements, the influence of fixing of the price on production, and methods of restricting consumption.

Observations on the recent agricultural inquiry in California, T. F. HUNT (*California Sta. [Pub., 1917]*, pp. 20).—The author discusses the findings of the committee on resources and food supply of the State council of defense. He recommends that the council devise means to bring city labor resources in touch with country needs, to organize tractor garages, to urge city capital and people to engage in the production of food, to promote plans of meeting the live-stock situation, to urge conservation of food and elimination of waste through organizations of women, and to assure the producer of high prices.

The great war: Its lessons and its warnings, J. COLLINGS (*London: The Rural World Publishing Co. [1917]*, pp. 115, pls. 2).—The author deals in a general way with the deficiencies of English agriculture in meeting national demands in time of war. A material reduction of the acreage in grass, more intensive cultivation and division of agricultural lands, reclamation of waste lands, and state aid to bring about reform are lessons emphasized.

A comparison of the systems of agriculture on the Continent, where intensified farming predominates, with that in England, is carried through the book.

The land and the Empire, C. H. TERNON (*London: John Murray, 1917*, pp. 144, figs. 28).—The author treats of errors in the policy of English agriculture in the past, which permitted a decrease in rural population as well as agricultural production. Occupying ownership, more practical education, betterment of labor conditions, and a more efficiently organized agricultural industry are urged as essentials in the solution of the problem.

The English land system, J. A. R. MARRIOTT (*London: John Murray, 1914*, pp. X+168).—The author traces the development of the English land system from the viewpoint of social and economic history. Its origin in the manorial system, the effect of the Black Death and peasant revolts, the agrarian revolutions of the sixteenth and eighteenth centuries, resulting in large estates and decay of yeomanry, and the causes and outcome of the periods of plenty, as well as depression, of the nineteenth century agriculture are noted with some detail.

The concluding chapter deals with the land problem to-day, reviewing such suggested solutions as land nationalization, a land commission to settle on such questions as "fair rent" and "security of tenure," and the increase in small holdings through a system of land purchase involving State assistance.

Land improvement in the Province of the Rhine, HEIMERLE (*Landw. Jahrb.*, 48 (1915), No. 2, pp. 171-277, pl. 1).—This is a survey of improvements made in Rhenish irrigation and drainage conditions during the past century. Technical, legal, and economic phases are studied, including soil and climatic conditions, drainage and drainage regulations, financial aid, economy of improvement and production increase, and general effect on commerce and population.

Madras agriculture.—A brief survey (*Madras: Dir. Agr. [1916]*, pp. 87).—The introduction briefly reviews conditions pertaining to general land economics. Following data of a general nature concerning the variety of crops produced, with the acreage distribution, each crop is considered separately in reference to its locality, manner of cultivation, improvement, and comparative quality. Statistical tables are presented for the principal commercial crops showing the quantity, value, months when available for export, and distribution of foreign trade.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt.*, 3 (1917), Nos. 6, pp. 45-56, figs. 2; 7, pp. 57-68, fig. 1).—These two numbers contain the usual data

regarding the estimated crop conditions of the more important crops, the estimated farm value of important products, and range of prices of these products at important markets.

In the first number special data are also given regarding the United States summary of farm prices, the monthly composite crop-condition estimates, index figures of crop prices, ten-year averages of conditions of crops, the estimated production in 1916 of the different varieties of wheat in the three spring-wheat States, special reports regarding Florida and California crops, the commercial production of strawberries, Bermuda onions, and early Irish potatoes, the date of harvesting watermelons, fertilizer used on cotton in 1917, the peanut acreage, the world's production of cereals by five-year periods, and the estimated acreage of hay. The number also includes a reprint of a special article on the uses made of the corn crop (*E. S. R.*, 28, p. 595), the length of cotton lint for the crops of 1916 and 1915, the international exports of wheat, and the monthly world export of wheat and flour for the five years 1910 to 1914, inclusive.

The second number contains special reports relating to honey yields and prospects, the commercial cherry crop, area planted to sugar beets, prices to producers of cotton and cotton seed, the production and acreage of grain sorghums, a special bean report, potato forecasts by harvest periods, data relating to prices indicating the increase in average of prices, and index figures of crop prices, commercial acreage and production of cantaloupe, and acreage and conditions of tobacco by types and districts, together with data relating to the acreage devoted to onions, etc.

AGRICULTURAL EDUCATION.

Proceedings of the thirtieth annual convention of the Association of American Agricultural Colleges and Experiment Stations, edited by J. L. HILLS (*Proc. Assoc. Amer. Agr. Colls. and Expt. Stas.*, 30 (1916), pp. 363, App. 3).—This is a detailed report on the proceedings, including the papers submitted and discussions thereof, of the meeting of the association held at Washington, D. C., November 15-17, 1916.

In addition to the papers and reports previously noted (*E. S. R.*, 35, p. 700), the proceedings also contain the following: Proposed Legislation to Establish Engineering Experiment Stations, by A. Marston (pp. 26-33); Scientific Management as Applied to the Farm, Home, and Manufacturing Plants, by C. R. Jones (pp. 108-115); Report of Joint Standing Committee on Projects and Correlation of Research (p. 133); Report of the Executive Committee (pp. 140-142); The Reserve Officers' Training Corps, Historical Statement, by W. O. Thompson (pp. 142-144); Problems and Opportunities Presented by the New Federal Army Reserve Law, by G. P. Benton (pp. 145-150); The Reserve Officers' Training Corps, by W. M. Riggs (pp. 150-152); Report of the Secretary, A. A. Potter, of the Engineering Division of the Section on College Work and Administration, setting forth in brief the history of the campaign in connection with the engineering experiment station bill (pp. 188, 189); The Appropriate Field in Engineering Extension for the Separate Land-grant College and the State University, by D. W. Spence (pp. 200-202); and by C. H. Benjamin (p. 207); Mechanic Arts of Sub-collegiate Grade in Land-grant Colleges, by C. E. Hewitt (pp. 212-215); and by W. N. Gladson (pp. 215-218); The Field of Engineering Experimentation, by R. L. Sackett (pp. 224-229), followed by a review by A. P. Davis of some of the possibilities or facilities of the U. S. Reclamation Service along these lines; Control of Engineering Experimentation in the Land-grant Colleges, by H. S. Boardman (pp. 232-234); The Cooperation of Teachers of Agriculture and Engineering in the Agricultural and Engineering Curriculum, by R. J. Aley (pp. 241-245); The Status of the Land-grant College as Outlined in Reports of Surveys Recently Made by the U. S. Bureau of

Education, by S. P. Capen (pp. 246-252); and Economic Factors to Be Considered in Connection with the Project for Extension Work among Farm Women, by E. Merritt (pp. 339-346).

Short courses in agriculture and home economics, W. J. REID ET AL. (*Agr. Gaz. Canada*, 4 (1917), No. 5, pp. 363-386, figs. 6).—This is a symposium on short courses in agriculture and home economics held in the past winter in the various Provinces of Canada. Approximately 500 short courses were held, with an aggregate attendance of 175,000 persons. Upwards of \$160,000 was appropriated for 1916-17 for instruction and demonstration and women's work.

Household science in normal schools, H. V. B. BRIDGES ET AL. (*Agr. Gaz. Canada*, 4 (1917), No. 5, pp. 400-407, figs. 2).—This is an account of the instruction in household science given in the normal schools of Ontario, Saskatchewan, and Alberta.

[Agricultural and home economics instruction in the public schools of New Hampshire], G. H. WHITCHER and F. H. DAMON (*N. H. Dept. Pub. Instr., Inst. Circ.*, 1915-16, Nos. 58, pp. 11; 59, pp. 22; 1916-17, No. 72, pp. 11, figs. 6).—These circulars deal respectively with methods of cooking meat and diets for invalids, including suggestions as to methods of teaching these subjects, and a description of a poultry plant made by the boys of the Dover (N. H.) high school.

Some exercises in farm handicraft for rural schools, H. O. SAMFSON (*U. S. Dept. Agr. Bul.* 527 (1917), pp. 38, figs. 41).—This bulletin is intended primarily for rural school teachers and for pupils of the seventh and eighth grades. It contains outlines of 25 exercises in the making of useful articles for the school, farm, and home. The exercises have practical application in the agricultural work of the school and also to the various club projects in agriculture.

Working drawings and photographs showing the construction of farm buildings for use in manual training schools (*Nat. Lumber Manfrs. Assoc., Trade Ext. Dept., Ed. Ser. [Pub.] 3* (1917), pp. 15, figs. 16).—This includes a corn crib, implement shed, granary, dairy house, poultry house, garage, and general-purpose barn.

MISCELLANEOUS.

Annual Report of Florida Station, 1916 (*Florida Sta. Rpt.* 1916, pp. 118+ IV, figs. 22).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1916, a list of the publications of the year, a general review of the work of the station during the year, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Thirty-ninth Annual Report of North Carolina Station, 1916 (*North Carolina Sta. Rpt.* 1916, pp. 267, pl. 1, figs. 56).—This contains the organization list, a report of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1916, and reprints of Bulletins 232-236. The experimental work reported is for the most part abstracted elsewhere in this issue.

Barn and field experiments in 1916, C. D. WOODS (*Maine Sta. Bul.* 260 (1917), pp. 85-120).—These experiments are presented in 13 articles abstracted elsewhere in this issue.

Monthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul.*, 5 (1917), No. 4, pp. 45-60, figs. 7).—This number contains brief articles on the following subjects: Hay Caps, by H. L. Blanchard; Blanching, Harvesting, and Marketing of Celery, by J. L. Stahl; Summer Spraying for Garden Pests, by A. Frank; Summer Feeding, by G. R. Shoup; Poultry Accounts, by Mrs. G. R. Shoup; and Concerning Moles, by T. H. Scheffer.

NOTES.

Alabama College and Station.—R. U. Blasingame, professor of agricultural engineering and agricultural engineer, resigned November 1 to become associate professor of farm mechanics in the Pennsylvania College.

Arizona University and Station.—Recent appointments to the board of regents include Dr. William V. Whitmore, of Tucson, formerly treasurer of the board, as president and chancellor; John P. Orme, of Phoenix; E. Titcomb, of Nogales; Dr. John W. Egan, of Prescott; and Captain J. P. Hodgson, of Blaine. State appropriations for the college and station have been made of \$72,569.50 for 1917-18, and \$75,164.15 for 1918-19.

California University.—The dedication of Hilgard Hall took place October 13. The new building is an elaborate 4-story structure, of reinforced concrete, 60 by 300 ft., costing with equipment about \$370,000 and constituting the second of the three buildings which will complete the agricultural quadrangle. It will serve as the headquarters of the college of agriculture, housing the departments of agronomy, viticulture, forestry, genetics, pomology, soil technology, and viticulture. A feature of the dedication exercises was a series of popular conferences on subjects connected with the work of each of these departments. A number of addresses commemorating the life and activities of Dr. Hilgard were also given, including one by Dean Hunt entitled *Carrying Hilgard's Work Forward*.

Connecticut State Station.—W. C. Pelton, county agent for Sussex County, Del., has succeeded Howard F. Huber as vegetable expert.

Illinois University and Station.—Warren R. Schoonover, instructor in soil biology in the department of agronomy and assistant biologist in the station, has enlisted in the gas defense service of the Sanitary Corps, U. S. Army.

Purdue University and Station.—W. J. Jones, Jr., professor of agricultural chemistry and State chemist for the past 10 years, died August 31, aged 46 years. He was a graduate of the university in 1891, and received the degree of M. S. in 1892 and that of agricultural chemist in 1899. His entire career was spent at the university and dealt especially with control work. He had long been a prominent figure in the Association of Official Agricultural Chemists and was widely known among fertilizer and feeding stuff control officials throughout the country.

Laurenz Green, chief in pomology in the Iowa Station, has been appointed head of the horticultural department. Harry M. Weeter has been appointed associate professor of dairy bacteriology and associate dairy bacteriologist, vice H. B. Switzer, who has accepted a position with the U. S. Department of Agriculture under the Food and Drugs Act with headquarters at Chicago.

Kansas College.—President Henry J. Waters has resigned to become managing editor of the weekly *Kansas City Star*.

Louisiana Stations.—Nicholas Kozeloff, Ph. D. (Rutgers, 1917), has been appointed bacteriologist of the Sugar Station, vice W. L. Owen, whose resignation has been previously noted.

Vermont University.—President G. P. Benton has been given a year's leave of absence for service with the National War Council in France. Dean G. H. Perkins, of the College of Arts and Sciences, has been designated acting president.

